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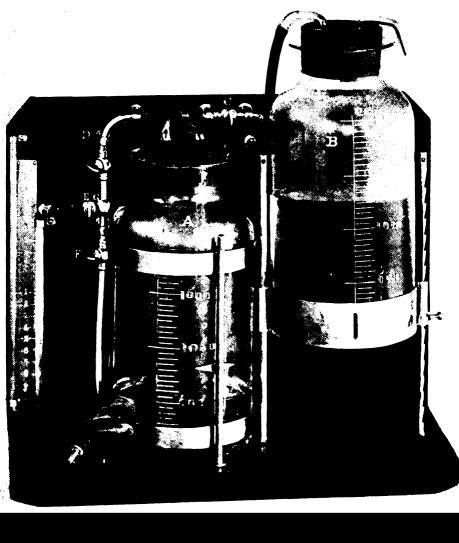
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# General medicine

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# **VOLUME I**

# GENERAL MEDICINE

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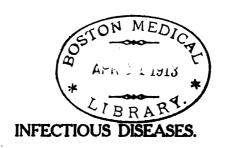


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## TUBERCULOSIS.

## ETIOLOGY.

Little has been learned during the past year as to the etiology of tuberculosis. The report of the *British Royal Commission* has finally been made and establishes the occurrence of bovine tubercle bacilli in the human organism and the occasional causation of pulmonary tuberculosis by this agent. The more frequent action of bovine tubercle bacilli in the causation of other forms of the disease such as glandular tuberculosis, seems to be admitted.

P. G. Heinemann<sup>1</sup> advises the following course toward bovine tuberculosis: Bovine tuberculosis in man is not negligible. It is an important factor and all precautions possible should be taken. The chief aim should be the eradication of tuberculosis from our dairy herds. This can be done successfully only by the systematic application of the tuberculin test, which in the hands of experts is more than 99 per cent. correct. Failures in revealing tuberculosis by this test are due generally to ignorance or failure to interpret the results correctly. With the high percentage of tuberculous cattle in our dairy herds the eradication of tuberculosis is a gigantic task and requires time. In the meantime all milk coming from herds which are not free from tuberculosis should be pasteurized. Recent scientific investigations have shown that the usual objections to pasteurized milk are without foundation, and pasteurization of milk is gaining rapidly in favor with sanitarians. A study

<sup>(1)</sup> Ill, Med. Jour., December, 1911,

of the methods of pasteurization has shown that the so-called holding process, where milk is held at a temperature of 140°F. for twenty to thirty minutes, is efficient, while the so-called flash process should be condemned. The tubercle bacillus is more resistant to heat than most other pathogenic bacteria, and some of the foremost investigators have shown that tubercle bacilli are surely killed by an exposure of twenty minutes to a temperature of 140°F. Pasteurization has the additional advantage of preventing epidemics of typhoid fever, scarlet fever, diphtheria and other infectious diseases.

Heredity. The inheritance of a predisposition to tuberculosis by the children of certain families can scarcely be denied. In what this predisposition consists is not decided. It must be referred to a lack of resisting power, as investigations show that practically all children become infected, but that the majority survive, having established a partial immunity. G. B. Sweeney<sup>2</sup> refers the immunity against tuberculosis to the action of the cells and particularly to the blood-cells which in a healthy organism are capable of resisting the attack of invading germs. An inherited weakness of the cells explains the predisposition to tuberculosis exhibited by many children of tuberculous parents.

Order of Birth. The hereditary influence appears to vary with the number of births. Contrary to what might be expected, the transmission of resisting power appears to be more successful with succeeding pregnancies. Combining German statistics with his own observations, W. C. Rivers<sup>3</sup> finds a preponderance of eldest-born among consumptives. As matters stand we may say that whereas in 1,228 consumptives one should find 196 eldest children, one actually does find 281; thus eldest-born consumptives are in excess by about 40 per cent. Sex has little influence.

Facts would seem to point to the conclusion that the tendency of the eldest-born to become consumptive is an innate tendency, and the hypothesis is strengthened if

<sup>(2)</sup> M. Y. Med. Jour., Nov. 4, 1911. (3) Lancet, Oct. 7, 1911.

we appeal to the literature of the subject. Lunatica and idiots are certainly very liable to consumption, and, as has been seen, it is exceedingly likely that they are disproportionately often eldest-born. Again, if faulty upbringing by inexperienced parents is to be made responsible for consumptive elder children, it must also be made responsible for elder-born criminals, lunatics, idiots, and perhaps men of genius, which would render an ordinary human responsibility sufficiently formidable. The existing evidence negatives the view that infection is the sole cause.

Innate tendency to consumption, a soil intrinsically suitable to the tubercle bacillus, phthisical predisposition original and autochthonous, not the result of weakening by other disease, is an idea which has always had Bacteriologic work may have limited the influence to be properly assigned to it, but an exclusive reliance upon bacteriologic arguments has often been proved dangerous; while such theories of the habitus phthisicus as stenosis of the upper thoracic aperture. which has considerable vogue in Germany, as the frequency in consumptives of small heart, of a condition of underweight, of supernumerary nipples, and of nasal defect have never been confuted. Eldest-born incidence might unite all these as co-ordinate degenerative manifestations; and eldest-born incidence, it may be noted, is absolutely proof against the objection, first advanced by Cohnheim, that the habitus phthisicus is a result of an already existing tuberculous infection.

H. E. Jordan<sup>4</sup> records a four-generation history of a tuberculous family, indicating the repeated occurrence of tuberculous members and affording strong evidence of a genetic factor in the causation of tuberculosis. He urges the importance of a more careful history of these relations in the study of tuberculosis.

Circumcision. According to I. M. Arluck and I. J. Winocuroff,<sup>5</sup> while in the cities infection from the use of saliva for stopping the bleeding in the Jewish rite of circumcision has practically disappeared, such

<sup>(4)</sup> Jour. Amer. Med. Assoc., Oct. 26, 1912. (5) Butrage z. Klin. der Tubergulose, B. 22, H. 3.

an occurrence in the country districts is not so very rare. They report a case of this kind in a child of 5½ months circumcised the eighth day, at which rite one of the guests sucked out the blood. An ulcer appeared on the penis, followed by swelling of the inguinal glands, and similar lesions in the pelvic glands, the mesentery, spleen, intestine, and a miliary tuberculosis of the lungs. Experimental tuberculosis of the penis has been excited from the application of tuberculous sputum to the penis, and the lesions were of a character similar to that shown by the patient.

Dissemination of the Disease. Wolff concludes that the spread of tuberculosis in the human body is always by a hematogenous route. The bacilli settle wherever an abnormal condition exists, i. e., where an organ is rendered unable to resist in consequence of a weakness in its original constitution or in its functions. These anatomic and functional abnormalities may be inherited or acquired. Thus the predisposition to tuberculosis consists in pathologic conditions, partly of anatomic, partly of a physiologic nature, which are a family or individual peculiarity, or are affecting the individual

merely for the time being.

Calcium Metabolism. Several authors, particularly Robin, Russel, and others, have endeavored to show that tuberculosis is closely related to a lack of calcium in the system. While the theory may be worthy of consideration, the evidence presented does not seem convincing. The following facts are assigned by C. F. Disen as justifying the conclusion that a deficiency of calcium determines a predisposition to tuberculosis. Pregnancy and lactation are said to favor tuberculosis, and we cannot doubt that much of calcium is being lost Workers in lime-kilns are under both circumstances. reported immune. Diseases of the heart afford immunity by loading the system with carbon dioxid which, we know, favors calcium anabolism. immunity of the gouty may be explained by his abundant assimilation of calcium, since his appetite for meat serves

<sup>(6)</sup> Beiträge z. Klin. der Tuberkulose B. 25, H. 1.
(7) Med. Record, July 6, 1912,



well to maintain the intracellular lime-attracting lipoproteins, while a perambulation of the abundant acid radicles, obligated by a high nitrogenous intake, necessarily enhances resorption of calcium.

[It must be admitted that these statements form a rather slender basis on which to build a theory of the

pathogenesis of this disease.—S.]

Rôle of Enzymes. J. Roux<sup>8</sup> develops a theory of resistance to the tubercle bacillus as depending on the action of enzymes. His investigations originated in the application of soap to tuberculous ulcers. In the course of these investigations he concluded that the soap acted by means of stimulating the cells to a katalytic action. Such katalytic action, he concluded, was due to the production of enzymes. He observed that certain animals showed greater resistance when fed on bran, and this he attributed to the fact that the bran contained diastase. Other experiments indicated that pancreatin and pepsin were also active in promoting the resistance of animals to tuberculosis.

He put his theories to the test of experimentation by injecting guinea-pigs with a culture of the tubercle bacillus. The animals were divided into three sets. The first set of controls received only an ordinary diet, which contains no diastaste. The second contained a diet similar to the first with the addition of bran. The third received in addition to this diet the author's solution of soap and a saturated solution of diastase, for twenty days. Forty days later they were given also the solution of soap and a supersaturated solution of pepsin. The results were that the first lot died promptly of tuberculosis. The second lived for eight months longer, while at the end of that period none of the last set had died. From these experiments the author concludes that the enzyme given was effective in prolonging the life of the tuberculous animals.

Further investigation is necessary for the development of his theory. He believes that the study of katalytic phenomena will explain a number of obscure facts. He says it is necessary to return to the ideas

<sup>(8)</sup> Prog. Med., Dec. 16, 1911,

of Claude Bernard. Prof. Widal has said: "It is in the domain of molecular and physical chemistry that medicine will find the final explanation of pathologic phenomena."

Influence of Winds. W. Gordon's reviews the evidence of the influence of strong, prevalent winds on the course of phthisis. There are several lines of inquiry which may be followed in order to ascertain whether winds exert an influence on the course of phthisis or not. We may (1) make continuous clinical observations on phthisis cases in some single locality under varying conditions of wind and rain; or (2) we may clinically observe and compare the effects on a series of phthisis patients of residence in sheltered and exposed situations; or (3) we may compare the collective results obtained by similar methods at differently located sanatoriums—some in shelter, some exposed; or (4) lastly, we may compare the average durations of fatal cases whose course has been run in places which present a suitable contrast of shelter and exposure.

The author presents tables and curves showing these relations. To conclude, it seems that these tables and curves, taken in conjunction with the other evidence alluded to, constitute a considerable *prima facie* case for the contention that exposure to strong, prevalent, rain-bearing winds tends to exercise an unfavorable influence on the course of phthisis. How far treatment may prove equal to neutralizing the unfavorable effect of these rainy winds remains to be seen. The cases here dealt with were mostly treated before the days of mod-

ern sanatorium methods.

Primary Infection in Childhood. The views of v. Behring that the initial infection with tuberculosis occurs in childhood and from a bovine source are well known. This investigator believes that the glandular tuberculosis received in childhood remains latent until adult life, when it spreads to the lungs and eventuates in consumption. P. H. Römer¹ states a similar view as follows: The tuberculosis received in childhood, if it

<sup>(9)</sup> Brit. Med. Jour., Feb. 10, 1912. (1) Beiträge z. Klin. der Tuberkuloge, B. 22, H. 3.

does not end fatally, leads to an increased power of resistance to tuberculosis as compared with the normal organism. This immunity is, as a rule, sufficient to protect against the infections coming from without in later years. If especial circumstances favor such an increase of the bacilli remaining in the organism that the existing degree of immunity is insufficient to hinder the spread of the disease, new foci of tuberculosis develop and new symptoms of tuberculosis appear. An especial factor favoring a metastasis to the lungs is found in the so-called paralytic thorax, which, at least in a large number of cases, is occasioned by a tuberculous infection in infancy of a relatively severe nature.

Römer concluded from his investigations that in the great majority of cases the pulmonary tuberculosis of the adult arises in an organism already infected in childhood, and that the previous experience of the disease has occasioned such a degree of immunity that the majority of individuals fail to become infected a second time, or at any rate, do not exhibit the acute symptoms of galloping consumption which characterize those infected for the first time with the disease. The amount of virus producing adult infection he regarded as massive, but he also recognized the possibility of a qualitative change in the infected organism.

On the basis of a material including 116 children treated by himself and 700 others of which he analyzed the clinical histories, W. Freymuth<sup>2</sup> formulates the fol-

lowing conclusions regarding Römer's thesis:

1. Among the classes affected with tuberculosis, practically no one escapes infection in childhood, so that in a large number of adults pulmonary tuberculosis takes its origin in an organism which has been already infected with tuberculosis, and probably at the time of the second infection still contains foci of the former tuberculosis.

2. The primary infection with tuberculosis has a different significance according to the age at which it occurs. During the first two years of life it is almost uniformly fatal, but gradually loses its dangerous

<sup>(2)</sup> Beiträge z. Klin. der Tuberkulose. B. 23, H. 4.

character after that time. This is, however, not true of pulmonary tuberculosis, which during childhood retains the malignant character of the tuberculosis of infancy. Most cases of tuberculosis between the ages of 6 and 15 are benign. It cannot be said that the primary infection usually leads to the galloping type of phthisis.

3. Pulmonary tuberculosis of adults is not to be regarded as a simple continuation of the disease of childhood, but is a new attack, either on the basis of a new exogenous infection or a further development of an old focus in the lung, arising, to be sure, in childhood and this, indeed, seems to be the most frequent origin. An endogenous infection of the lung in Römer's sense surely occurs.

For the outbreak of the disease, the social and personal violations of sanitary laws are of essential importance, as well as the environment of a tuberculous family; for the course, the determining factors are the degree of immunity following the first infection and the severity of the second infection. It is improbable that a severe tuberculosis in childhood is the chief basis of pulmonary tuberculosis. It is also improbable that a massive infection is necessary to arouse ordinary phthisis; such infections lead to the florid pulmonary tuberculosis of adults.

- 4. Prophylaxis against tuberculosis should begin in infancy and should be directed against the infection of the first two years against which we are therapeutically powerless. For the prophylaxis of the tuberculosis of adults the best remedy is the energetic treatment of the disease in children of school age. Typical pulmonary tuberculosis in children is scarcely influenced by treatment. An object earnestly to be sought and probably attainable is the segregation of such children in asylums, for their number seems to be relatively small. These asylums could be attached either to sanatoria or to ordinary hospitals.
- 5. All previously employed measures designed to protect adults from infection should be strictly enforced, for nothing has shown that a healed tuberculosis con-

fers immunity against a second exogenous infection, so that a reinfection has no pathologic activity.

Exacerbations. K. Dietl and F. Hamburger<sup>3</sup> report the results of experimental work which indicate that an animal which has been infected with tuberculosis retains a certain immunity to a second injection of the virus. They infected healthy guinea-pigs with so small a number of tubercle bacilli that the animals lived seven to eight months after the first infection. Then after local tuberculosis had developed they produced a cutaneous infection, and at the same time produced cutaneous infection of some control animals. The cutaneous tuberculosis in the control animals took a more acute and serious course than in those previously infected. Ulcerations were produced in the control animals, while no characteristic lesions were to be discovered in those reinfected. In several of the reinfected animals the reinfected place formed a scab and healed, leaving a scar. In others ulceration occurred, and in some cases an exacerbation took place after apparent healing.

The authors interpret phthisis in man as an exacerbation of an infected area in an organism, previously infected in childhood, which has attained a certain immunity. This immunity is sufficient to hinder the further development of the germs producing the second infection, and apparent healing may take place. Such apparently healed lesions may take on increased activity after the immunity at first achieved has diminished,

and an exacerbation may occur.

The behavior of the animals submitted to reinfection varied with the individual animal showing a different constitution, which is similar to the predisposition exhibited by certain individuals of the human species.

Immunity by the Injection of Attenuated Living Bacilli. J. C. Meakins has experimented to determine the production of immunity by the injection of attenuated living bacilli. He determined the degree of immunity by the phagocytic power of the blood-serum

<sup>(3)</sup> Beiträge z. Klin. der Tuberkulose, B. 24, H. 1. (4) Canad. Med. Assoc. Jour., December, 1911.

according to the method of Kline. The blood-serum is collected in the usual manner, both from the patient or animal infected, and from a normal individual of the same species. The leukocytes are collected as in Wright's work, and a suitable emulsion of the infecting organism is prepared. The blood-serum is then diluted to various strengths, which may reach one part in one thousand, or higher if necessary. Then capillary pipettes are prepared, as described by Lieschmann, and equal parts of diluted serum, leukocytes, and bacteria are mixed and incubated at 37°C. for a definite length of time, varying with the organism used. At the end of this period smears are made and suitably stained. In addition to the pipettes containing immune and normal serum, one is prepared substituting 0.85 per cent. salt solution for the serum and treated as described above. The average number of bacteria per leukocyte in the preparation with salt solution is taken as the degree of spontaneous phagocytosis. The preparation made with the most diluted serum, which shows approximately this number, is taken as the point where opsonins have ceased to be active.

His tables show the failure of tuberculin to produce an appreciable immunity. The immunity produced by the injection of the attenuated, living, human bacillus and the killed bovine bacillus was absolute, in so far as a lethal dose of virulent tubercle bacilli was concerned. It is not possible to state that this immunity was altogether due to the increase in the phagocytic power of the blood.

From these facts the question presents itself as to how they might be applied to the problem of human tuberculosis. For such a protective inoculation to be applicable, the person vaccinated must be free from tuberculosis. As this is a rare occurrence in adults, suitable subjects must be looked for in those young enough to have escaped infection. It is claimed by many workers that tuberculosis infection occurs in the large percentage of cases during the early years of childhood; therefore it would be before this period that the best results and greatest benefit of protective inoculation.

would be obtained. Naturally the success of such an undertaking would depend upon the production of a high degree of phagocytic immunity, as this is the only method by which the resistance of the animal organism to virulent tubercle bacilli can be estimated.

Conclusions: (1) The inoculation of the rabbit with attenuated, living tubercle bacilli rapidly produces an immunity to lethal doses of virulent, tubercle bacilli. (2) The inoculation of the rabbit with killed tubercle bacilli in sufficient amounts over a long enough period produces an active immunity to virulent tubercle bacilli. (3) The estimation of the phagocytic power of the serum affords a fairly accurate estimate of the immunity possessed by the animal immunized. The injections into the rabbit of tuberculosis toxin or "old tuberculin" does not produce any increase of the phagocytic power of the serum, nor does it produce any appreciable immunity to virulent tubercle bacilli. (5) The fact that the injection into the rabbit of killed tubercle bacilli produces an immunity to virulent tubercle bacilli might be taken advantage of to produce an immunity in infants before they become primarily infected with tuberculosis.

Tuberculin Reaction, F. Meyer and K. E. Schmitz<sup>5</sup> propose as the result of certain investigations a theory of tuberculin action similar to that of Spengler, namely, that the tuberculin reaction is closely associated with the red blood-cells. After injection of the smallest quantities of tuberculin these are taken up by the erythrocytes and carried to the focus of disease. There are found the first and strongest receptors for tuberculin (Wassermann's antituberculin), while on longer existence of tuberculosis other receptors are formed in the cells of the blood. The strong receptor apparatus found in the foci of the disease exerts a powerful attraction on the blood-cells loaded with tuberculin, and so excites a hyperemia outside of the focus and a focal reaction. At the same time by the union of the receptor with the tuberculin a toxin which is set free excites the general reaction. If the case is progres-

<sup>(5)</sup> Deutsche med. Wochenschr., Oct. 17, 1912.

sive the receptors of the serum and of the cells are saturated to such an extent with tuberculin that this setting free of toxin can no longer take place after the

injection, and the reaction is lacking.

The repeated injection of small amounts of tuberculin leads to the formation of continually increasing quantities of toxin and is answered by the body with an insensitiveness, probably on account of the formation of an antibody, a genuine antitoxin. This seems to circulate in the serum and is probably identical with the neutralisins described by Pickert and Loewenstein, substances which are recognized by the fact that they permit the exciting of v. Pirquet's reaction without the action of complement, so that they are not identical with the antituberculin of Wassermann. If this body is a genuine antitoxin against the poison that arises from the union of the receptors existing in the blood-corpuscles with the tuberculin, then the tuberculin immunity which occurs in the course of treatment is easy to explain. The toxins which arise are rendered harmless by the neutralisins before the occurrence of the general reaction. The most important question which must be investigated later is the determination of the genuine antigenic nature of this poison.

The facts and conclusions reached by the authors are new, even if Spengler a long time ago proclaimed that red blood-cells are the producers of antitoxin, and produce the immune bodies from the erythrocytes of immune men and animals. Meyer and Schmitz cannot agree with his conclusions because their researches give no reason for assuming a final immunity. As Spengler's immune body provokes a reaction and can be used only with care in increasing doses, it probably represents the bodies described by them as reaction bodies, which through combination with the tuberculin of the organism produce fever. In that way his treatment constitutes a reversal of the original tuberculin treatment. interesting relation to the results obtained by Meyer and Schmitz is the recent statement of Abderhalden that the blood-plasma of tuberculous patients in contrast to that of normal individuals is capable of exhausting a peptone derived from tubercle bacilli. According to the assumption of the great rôle of the erythrocytes in the pathology of tuberculosis the curative action of mountainous and sea climates would be easy to understand.

## SYMPTOMATOLOGY.

General analyses of collected cases in sanatorias, etc., afford an opportunity to judge of the relative importance and frequency of various symptoms. An unfortunate characteristic of tuberculosis is its insidious onset, the frequent absence of characteristic symptoms, or the undue prominence of symptoms referable to other organs besides the lungs. The misunderstanding of such symptoms frequently leads to erroneous or delayed diagnoses.

Analyses of Collected Cases. S. G. Bonney<sup>6</sup> reviews the tuberculous cases treated by him within the past year in comparison with a similar review made several years ago. With reference to the former he states:

As a result of this analysis, two central thoughts were

suggested.

1. It appeared that attempted over-niceties of diagnosis sometimes resulted in the incorrect interpretation of physical signs, a judicious discrimination not always being in evidence as to the relative importance of the various features. In the commendable zeal for early diagnosis it seemed that a source of error was found in our enthusiasm to recognize somewhat obscure physical evidences of infrequent occurrence and doubtful import.

2. It was apparent that in advanced cases, faith in the efficacy of home treatment and in the advantages of local institutions was responsible to a degree for disastrous delay, and hence in some cases, for the unfortunate condition of those seeking climatic aid as a

last resort.

In the year ending Nov. 1, 1910, 222 new patients having real or supposed tuberculous involvement pre-

<sup>(6)</sup> Amer. Jour. Med. Sciences, November, 1911.

sented themselves for treatment. Of the 222 new patients, the physical and bacteriologic findings were negative in 55. Several before arrival and subsequently responded positively to one of the integumental tests. A large proportion of these patients were influenced to leave home immediately upon the development of cough, elevation of temperature, slight loss of weight, general malaise or other suspicious symptoms, and in very many instances, even without the advice of a physician. Some presented the history of bronchitis of indefinite duration, asthma, emphysema, general debility, malaria, and neurasthenia. Symptoms suggestive of mixed infection were exhibited by 19 and corroborated by the bacteriologic findings. Of these, 13 presented the history of one or more pulmonary hemorrhages, in none of which cases were tubercle bacilli discovered. thought is conveyed that possibly hemoptysis among non-tuberculous invalids is more frequent than commonly supposed. Attention has previously been called to fairly numerous instances of pulmonary hemorrhage resulting from vicarious menstruation, purpura hemorrhage, and circulatory embarrassment incident to chronic bronchitis, emphysema and pneumoconiosis. Nearly all patients having one or more hemorrhages without definite evidences of tuberculous involvement presented the history of a sudden onset with chill, fever, cough and expectoration. In a few cases the clinical course had been of so acute a type as to suggest the probability of an actual pneumonic process with a central or concealed area of involvement. In one or two cases a definite recognition of the pneumonic consolidation was obtained after arrival in Colorado.

A review of the foregoing statistical data serves but to accentuate previous impressions with reference to the early diagnosis and management of tuberculosis. From these studies, it seems reasonable to assume that while much has been accomplished in the past few years in the education of the public, there is still something to be desired. It is to be expected that among different clinicians in varying localities, divergent views should be entertained according to the peculiarities of individual

experience. In this instance, due significance must be attached to the number of persons sent away from home without positive evidence of tuberculosis, to the comparatively few early cases, the large proportion in moderately or far advanced stages, and the frequency of incurable complications. Opportunity has been permitted to note the disadvantages of routine tuberculin administration and the inevitable limitations of the sanatorium unless in a properly co-ordinated relation to other important measures of treatment. It is vitally important to recognize the value of a properly selected climate, the fundamental consideration being that of individual fitness. It is well known that notwithstanding a possible unhygienic environment and improper food and clothing, many incipient cases do recover at home; and that despite unfavorable climatic conditions, others somewhat more advanced, may exhibit periods of improvement while confined in closed sanatoria. While consumptives may recover in unsuitable regions, they are more likely to do so in localities wisely selected with reference to individual needs. In some instances, prompt recourse to a suitable climate represents the determining factor, but this is capable of exerting its greatest influence only when combined with a reasonable interpretation of modern hygienic and dietetic man-Experience has shown that many patients, who, through financial distress are deprived of the advantages of a supervisory régime, nevertheless are permitted to secure improvement amidst favorable climatic surroundings. To those compelled to work for a livelihood sojourn in a suitable locality may offer the only means of an eventual restoration of health. arrest having been secured, a continued residence precludes in many instances the relapse so common among individuals returning to their former occupations at home. In the interest of the consumptive class it is to be hoped that an increasing appreciation of the value of climate for properly selected cases may be justly entertained.

The Vermont Medical Monthly reports the results of

<sup>(7)</sup> Dec. 15, 1911.

a study of 350 cases of pulmonary tuberculosis at the Vermont sanatorium, Pittsford, Vt. The fact that grippe, pneumonia and pleurisy are mentioned so frequently would lead one to suspect that in some cases such illnesses were, in fact, previous tuberculosis exacerbations.

The body weight was the most interesting physical characteristic noted in the cases. Many individuals go through life without ever attaining their full weight, so that one cannot accept their previous average or maximum as a standard for them, or consider it a basis for comparison in determining the state of nutrition at the time of admission. Of these 350 cases it has been generally observed that very few ever reached the standard for their age and height as determined by the New York Life Insurance Curves. Of 334 patients whose weight is recorded 77 or 20.1 per cent. were 10 pounds below weight, 186 or 55.7 per cent. were from 1 to 20 pounds below weight, 203 or 60.8 per cent. from 1 to 30 pounds below, 35 or 10.4 per cent. 31 to 40 pounds below and 6 or 1.8 per cent. 41 to 50, and one case more than 50 pounds below weight. In other words, a total of 305 or 91.3 per cent. of the cases were below normal weight. A total of 25 or 7.4 per cent were from 1 to 40 pounds above weight. An interesting question is whether the impaired nutrition is the result of the disease or whether a condition of impaired nutrition and lowered power of resistance favors the development of the disease.

It has been stated that tall, spare people are more liable to tuberculosis than short, stout people. The table of height showed that there were fewer men above the average height than those at or below, while in the case of women those who were less than the average height slightly outnumbered those who were at or above the average. Thus of 147 men 65 or 44.1 per cent. were 5 feet 8 inches or more and 82 or 55.9 per cent. were less than 5 feet 8 inches. Of 182 women 90 or 49.5 per cent, were 5 feet 4 inches or more in height, and 92 or 50.15 per cent. were less than 5 feet 4 inches in height. Some attention has been paid by some observers to

the significance of complexion in tuberculosis. It was noted that of 309 cases 202 were dark, 104 were light and 3 florid. In order to make these figures of value it would be necessary to know the proportion of each complexion among the total population.

# Predisposition Causes Presented in the 350 Cases.

Indoor occupation	285
Overwork	<b>75</b>
Hereditary tendency	74
Previous illness	<b>58</b>
Dusty trades	<b>4</b> 0
Unfavorable surroundings	19
Other causes	16
No causes given	47
In some cases two or more factors were present at	the
same time.	

# First Symptom in the 350 Cases.

Cough 11	.9
Weakness 6	9
Pleurisy 4	:3
Hemoptysis 3	9
Catarrh 1	4
Fever 2	0
Intestinal disturbance	4
- y ~p	4
Loss of weight	
Night sweats	
Palpitation	
Not stated 2	8

Occurrence of Certain Important Symptoms in the 350 Cases.

Sputum examinations were positive in 203 or 58 per cent.

Sputum examinations were negative in 137 or 36.7. per cent.

Sputum examinations were not considered in 10 or 5.8 per cent.

Hemoptysis was noted in 139 or 39.7 per cent.

General appearance was unfavorable in 197 or 56.2 per cent.

Night-sweats occurred in 87 or 25.8 per cent. Thoracic pain was noted in 171 or 48.8 per cent.

Temperature (av. d. max. f. 1 wk.) was over 100° F. in 43 or 15.1 per cent.

Pulse (av. d. range f. 1 wk.) was over 100 in 129 or 49.4 per cent.

# Results of Treatment of 318 Patients Discharged from the Vermont Sanatorium.

#### Condition on Admission.

Mod. Adv. 1	27= 39.9 per cen 171= 53.8 per cen 19= 5.9 per cen 1= 0.3 per cen	t.	Arrested, 53=41.7 per cent. 60=55.0 per cent. 6=31.6 per cent.
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Total 318=100 per cent. 62=19.4 per cent. 119=37.4 per cent.

## Condition on Discharge.

T	Improved.	Failed.	Died.	
Incipient Mod. Adv. Far Adv.	22=17.3 per cent. 58=33.9 per cent. 3=15.7 per cent.	2= 1.6 per cent. 37=21.6 per cent. 10=52.6 per cent.	4= 2.3 per cent.	
Gen. Mil. Tb.	o—10.1 per cent.	10	1=100. per cent.	
Total	83=26.1 per cent.	49=15.4 per cent.	5= 1.6 per cent.	

Significance of Symptoms. As a rule physicians do not attach enough significance to the early symptoms of pulmonary tuberculosis. In a doubtful case the diagnosis is often delayed until definite physical signs appear in the lungs, or the patient is kept waiting until tubercle bacilli are found in the sputum. In order to get an idea of the true value of early symptoms in individual cases of pulmonary tuberculosis, H. D. Chadwick and H. S. Wagner<sup>8</sup> have made a careful study of the histories of 200 cases treated at the Westfield State Sanatorium. Of these cases, 100 obtained an arrest of the disease and 100 died while under treatment or within a few months after discharge. They

<sup>(8)</sup> Boston Med. and Surg. Jour., Sept. 19, 1912,

compare these two groups of patients to determine what symptoms may be considered favorable or unfavorable, in forecasting a prognosis or in determining a diagnosis.

They emphasize the importance of watching for early subjective symptoms, as by them a diagnosis may be made before ulcerative processes occur to free the bacilli. Moreover, the finding of bacilli depends much upon the persistence of the search made for them; and tuberculosis, even in advanced form, may be present without the bacilli appearing in the sputum. Finally, in suspicious cases it is better to give patients the benefit of the doubt by telling them that their symptoms indicate early tuberculosis and to prevent further progress it will require a radical change in their mode of living. If a patient is sent to a sanatorium with a doubtful diagnosis no harm will have resulted, even if it should prove to be a simple bronchitis or an influenza infection.

The treatment is the same for the tuberculous and the non-tuberculous, and no harm has yet been known to result to a patient sent to sanatorium even with a mistaken diagnosis, while irremediable harm results to many patients who are kept waiting for unmistakable

symptoms of tuberculosis to develop.

While the family physician may not be skilled enough to recognize obscure physical signs, he does have the opportunity to note subjective symptoms and his routine work tends to make him a keen observer. Physicians must recognize tuberculosis when it manifests itself by loss of weight or strength, or a pulse of 90, an elevated afternoon temperature, blood spitting, pleurisy, or a cough. Any combination of these symptoms which can not be explained by other causes should be considered sufficient proof of active tuberculous infection.

Failure to make a positive diagnosis from these symptoms is too vital an error for a patient to forgive, but a mistaken positive diagnosis leads to the right treatment,

has no fatal sequel, and will soon be forgotten.

Fever, Its Cause and Treatment. The fever which accompanies tuberculosis is a symptom poorly understood and unsatisfactorily treated. The most generally accepted theory at the present time is still unsatisfac-

tory, and the importance of its further investigation is self-evident. The cause of the chronic fever in tuberculosis and the factors which produce the irregularities

in its course are numerous and complex.

The finding of bacteria of various kinds in the sputum of tuberculous patients, especially the pus-producers, has given grounds for the belief that tuberculosis, when it reaches the open stage, is a different process from that of early tuberculosis; and that the principal factors in the production of the symptoms in the later stages are the associated bacteria. This mixed infection theory was accepted by the profession generally. It called forth many such statements as these: "The tuberculous process is a dry process. If the tubercle breaks down it is because of mixed infection."

F. M. Pottenger<sup>9</sup> believes that the primary causes are at least three in number: the tubercle bacillus and its toxins; associated bacteria and their toxins; and enzymes and the products resulting from their action upon the body cells. This last cause is generally disregarded in discussions on this subject; and yet it is a factor of great importance in all cases of advanced tuberculosis of the ulcerative type.

Two factors, the tubercle bacillus and the products of autolysis, are present in all cases of advanced tuberculosis. These factors are present in varying degrees which depend somewhat on the activity of the process.

Associated bacteria are not an important etiologic factor in the production of all fevers which rise beyond moderate elevations in advanced tuberculosis, although they are unquestionably so in some. The fibroid form presents a low degree of virulence due to the small amount of toxin set free, while the ulcerative form combines the effects of a large amount both of tuberculous toxin and of the products of autolysis. Where the tubercle bacilli are supplemented by associated bacteria, we have the severest form of the disease; for here we have both the effects of the various bacteria and their toxins and an increased autolysis.

While we look on the three factors as being the pri-

<sup>(9)</sup> Jour. Amer. Med. Assoc., Sept. 23, 1911.

mary causes of the elevations in the general temperaturecurves in tuberculosis, there are many factors which contribute to the variations found in these curves, some of which are subjective and others objective. Physical exertion is one of the most common causes of elevation in the temperature-curve. Mental perturbation is also frequently followed by variations in the temperaturecurve. Thought, reading, excitement, worry, joy, disappointment and fear all have their effect. The effect of a large meal is often seen. Intercurrent complications, such as constipation, indigestion, colds, pleurisy, toothache, as well as the more serious ones, such as pneumonia, pneumothorax, and emphysema, all affect the regular curve. The effects of indigestion and constipation are often shown in a rise of temperature.

There has been too much of a tendency to deal in generalities in discussing the fever in tuberculosis, and the factors which produce it. It is commonly believed that every temperature above 100.4°F, is due to mixed infection. It is likewise believed that every patient who is having a high temperature is saturated with tuberculin which is circulating through his tissues. Nearly every rise in temperature which causes a temporary rise in the general curve is interpreted by many observers to mean an auto-inoculation of tuberculin. A moment's consideration of the underlying pathology and the conditions and influences surrounding the individual patient, however, will readily demonstrate that such general statements have no place in dealing with this disease. At best, it will be seen that treatment of these conditions is a very complex proposition. It is especially necessary to interpret carefully the temperature-curve when tuberculin is employed therapeutically.

Many of the contributing causes of fever can be avoided, while some, such as those depending on thermometric and barometric conditions, must be endured. Overexertion can be avoided by a little care. The effect of mental activity can, as a rule, be overcome. Reading, thinking and excitement are largely within the power of the patient to control, while worry and disappointment can usually be avoided to a large extent if

the patient and physician are in thorough sympathy with each other and are co-operating as they should. Most of the complications which arise cannot be relieved at once. Some cannot be relieved at all. Some must run a regular course; but close personal medical supervision favors accuracy of diagnosis and affords rapid relief from many of them.

Carefully regulated hygienic living in the open air, with rest for both the body and mind, food, selected according to the patient's digestive capacity, and various hydrotherapeutic measures may be advantageously

employed in all cases.

Tuberculin has partly won for itself, through probably the most severe trial to which a remedy has ever been subjected, the right to be considered as a specific against tuberculosis. Vaccines made from dead culture of various bacteria associated with tuberculosis have proved to have specific action against pathologic conditions which are produced by their own strain. In spite of these specifics against the bacteria there are many foci which we cannot heal, many temperatures which we cannot lower in advanced tuberculosis. One reason for this is inexact diagnosis; another, that we have no specific against the enzymes and the products resulting from their action. Would it not be profitable to attempt the production of specific remedies against the body enzymes and the products of their action? This would not seem impossible, for Jochmann and Kantorowicz and others have demonstrated anti-enzyme in the blood. Our conception of the machinery of immunity is such that we are led to believe that the cells of the body must produce substances which protect the body from these enzymes and the broken-down tissues, which are the products of their action. Our conception is that in these advanced cases, the body cells are constantly producing substances which protect the body against the tubercle bacillus and its toxins and the enzymes and the products of their action; and, where other bacteria are associated in the process, against these. Our rational therapy will be effective only as it aids and supplements these natural processes,

The reason usually assigned for the non-employment of tuberculin in fever is that the patients are already saturated with tuberculin. That this is not necessarily true can easily be established. In the first place, it is probable, as mentioned above, that tubercle toxins are not the chief factor in the production of fever. Again, if the system of the fever patient were completely saturated with tuberculin, all foci would be the seats of focal reactions which could be easily detected in all visible tuberculous processes such as ulcerations of the larynx and pharynx. But this is not true. Such processes show the focal reactions, however, after injections of therapeutic doses of tuberculin, which, in amount, are short of a fever reaction. Still again, if this were true, all tuberculous foci would break down as a result of the constant focal reactions. Furthermore, if the patient were saturated with tuberculin, the temperature would fall: for excessive doses of toxins would overcome the patient's reactive powers and cause a drop in temperature.

The reason that tuberculin should be employed in the treatment of patients suffering with fever is the same as that for employing it in non-febrile cases; that is, for its effect on the healing of the purely tuberculous processes.

Leukocytes. W. W. Watkins¹ summarizes as follows the most important known facts regarding the white cells in tuberculosis: In resisting a tuberculous infection it has long been known that the lymphocyte is the cell particularly effective against this bacillus. The term "lymphocyte," as used herein, classes under that word, without any attempt at differentiation, both the small mononuclear leukocyte (the lymphocyte of Ehrlich or small lymphocyte of American writers) and the large mononuclear leukocyte (the large lymphocyte of American writers), since no one has yet made any distinction in their function. That these cells are attracted particularly by the tubercle bacilli is doubtful, their effectiveness against these organisms being largely explained through the work of Bergel, confirmed by Webb and his assistants, that only lymphocytes have the abil-

<sup>(1)</sup> Jour. Amer. Med. Assoc., Dec. 30, 1911.

ity to dissolve the waxy sheath enclosing tubercle bacilli and protecting them against the destructive antibodies of the serum and against ordinary phagocytes. It is the universal observation of hematologists that there is an increase in the lymphocytes in tuberculosis, but the conclusion heretofore drawn, that this lymphocytosis is due to secondary amenia resulting from the disease, is erroneous, for this increase in mononuclear cells occurs only during the process of recovery from, or successful resistance of, tuberculosis, and does not occur when the disease is progressing unfavorably. A fact which simplifies routine observation in this connection is that when there is an increase in the mononuclears (except in lymphatic leukemia, in which all the elements are increased), this change in percentage is due to an actual relative increase and is not accompanied by a rise in the total leukocyte count.

Watkins made observations on 100 individuals with results as follows: Twenty-two healthy adults gave an average lymphocyte count of 41.5 per cent., ranging from 29 per cent. to 57.5 per cent. Thirteen patients definitely cured of tuberculosis of the lungs gave an average lymphocyte count of 45 per cent., ranging from 35 per cent. to 67 per cent. Twenty-four counts on patients with tuberculosis checked or healing gave an average percentage of 38, ranging from 30 per cent. to 50 per cent. Forty-four counts from patients in whom the disease was gradually or rapidly progressing gave an average of 25 per cent., ranging from 10 per cent. to 35 Six who were not seen after the original per cent. examination, but whose cases were all advanced, gave an average count of 24 per cent. Two adults presenting themselves as normals, but whose appearances were suspicious, gave counts of 19 per cent. and 20 per cent.

From these results the following conclusions are drawn:

- 1. The percentage of lymphocytes affords an apparently reliable indication of individual resistance to tuberculous infection.
- 2. The presence in many healthy individuals of a considerable increase in the percentage of lymphocytes justi-

fies the conclusion that an individual presenting such an increase in the number of those defensive cells known to be most effective against tubercle bacilli presents likewise an increased resistance against infection by those organisms.

3. There exists in human beings who have definitely recovered from tuberculosis a permanent increase in the percentage of lymphocytes, the counts ranging from 40 to 70 per cent. That such an increase in those cells known to be particularly destructive to tubercle bacilli affords a relative immunity to tuberculous infection is a natural conclusion. This is a definite biologic confirmation of the much disputed statement that cured tuberculosis produces immunity.

4. In patients with active tuberculosis there occurs coincidently with or preceding the checking of that activity an increase in the number of lymphocytes. This lymphocytosis is so definite and unfailing that it offers the most dependable means of foretelling the future

course of the disease.

5. Preceding a lessened resistance there occurs a de-

crease in the number of lymphocytes.

6. The blood of tuberculous patients with lymphocytosis presents, usually, an interesting picture, very different from that of normal blood. The increase is usually in the mononuclear cells, which may be two or three times as large as the polynuclear cells and have large

irregular cytoplasms.

7. Mixed infection with pyogenic organisms may bring about an increase in the number of polynuclear cells and a relative decrease in mononuclears, but the clinical fact remains unaltered that the percentage of lymphocytes is an exact and reliable indication of the course which a tuberculous process will assume in the immediate future.

M. Solis-Cohen and A. Strickler<sup>2</sup> report the results of studies of leukocytes in tuberculosis with the following conclusions:

1. Improvement in pulmonary tuberculosis is associated with an increase in the proportion of lymphocytes

<sup>(2)</sup> Amer. Jour. Med. Sciences.

in the blood at the expense of the polymorphonuclear cells. As the patients grow worse the proportion of polynuclear cells increases at the expense of the lymphocytes. None of the other types of white cells are affected by either condition. As a consequence, the percentage of lymphocytes will usually be less and the percentage of polynuclears will be greater, the more advanced the disease and the greater the amount of lung tissue involved.

- 2. As a patient begins to improve there is usually an increase in the proportion of polynuclear cells containing one and two nuclei, the increase often being maintained for several weeks, but not indefinitely.
- 3. Mononuclear, transitional and eosinophile cells are unaffected by the stage, extent or progress of the disease.
- 4. The leukocytic picture in pulmonary tuberculosis corresponds with the patient's resistance to the disease rather than with the extent of the lesion.
- 5. By means of the leukocytic picture it is often possible to determine the resistive power of a tuberculous patient and to form a fairly accurate estimate of the chances for recovery.

Solis-Cohen and Strickler<sup>3</sup> have also investigated the condition of the leukocytes under various forms of treatment. From a study of the leukocyte counts in 50 cases they conclude as follows:

1. Bier's suction hyperemia in eases suitable for this treatment causes an increase in the proportion of lymphocytes and of multinuclear cells with one and two nuclei.

2. Applying fly-blisters every five days and allowing the serum to become absorbed causes an increase in the proportion of multinuclear cells with one and two nuclei, and in most instances an increase in the proportion of lymphocytes.

3. Iodin in the form of iodoform administered by the mouth causes an increase in the proportion of multi-

nuclear cells with one or two nuclei.

4. Creosote, given in the form of the carbonate, causes

<sup>(3)</sup> N. Y. Med. Jour., Jan. 13, 1912.

an increase in the proportion of lymphocytes and of multinuclear cells with one and two nuclei.

5. Nuclein seems to cause an increase in the propor-

tion of polymorphonuclear neutrophiles.

6. The effect produced in the blood by many therapeutic measures is not, as a rule, maintained indefinitely, but only for a variable period, averaging about a month.

From an investigation of the effect of tuberculin treat-

ment in six cases they found that:

1. In all cases there was an increase in the proportion of multinuclear cells with one and two nuclei during tuberculin treatment; in two cases, however, being preceded by a fall.

2. In four of the six cases the lymphocytes were increased during tuberculin treatment, a slight intermediate fall, however, occurring in one after three

months on the same dosage.

3. Tuberculin given by the mouth in very small doses, very gradually increased, apparently produces an alteration in the proportions of the different forms of leukocytes.

Blood-Pressure. Schnitters<sup>6</sup> has investigated the relations of the blood-pressure in 101 cases of tubercu-

losis, and reaches the following conclusions:

1. The lowering of the systolic and diastolic bloodpressure during acute and chronic pulmonary tuberculosis is so regular a symptom in the majority of cases, especially in those pursuing the course of a severe toxemia, that it may be regarded as of diagnostic value.

- 2. The blood-pressure in all probability is lowered in the early stage of tuberculosis and almost always continues at the same height whether the disease pursues a fatal course or is benign and tends to recovery. In the case of tuberculosis that has become inactive and remains inactive for a long period of time the blood-pressure in a certain percentage of cases rises to normal and even above normal.
- 3. Analogous to the variations of blood-pressure in healthy men between muscular exercise and complete rest of the muscles there are also found in phthisical

<sup>(4)</sup> Beiträge z. Klin. der Tuberkulose, B. 23, H. 2.

patients who are treated as ambulant patients somewhat higher maximal and minimal pressures (on the average 110 and 65 mm. of Hg.) than in patients at rest (102

and 59 mm. Hg.).

4. Regularly fixed relations between blood-pressure and the course of fever, of such a kind that with the higher temperature higher pressure is also found, exist only in so few cases that they must be regarded as exceptions. On the average blood-pressure and the height of the temperature are quite independent of one another. The high pressure is found quite as often in the same case with a low temperature as the reverse, a low pressure with high fever.

5. The same is true of the blood-pressure and the rapidity of the pulse, and of the blood-pressure and the occurrence of sweats. Only in case of colliquative sweats is there a certain connection recognizable, especially as a pronounced fall of blood-pressure seems regularly to occur at the end of the sweating stage together with a

lowered temperature.

6. In certain cases of acute miliary tuberculosis, especially with involvement of the meninges, the previously normal or lowered blood-pressure may rise to a marked degree, a symptom that under some circumstances may facilitate and confirm this diagnosis.

7. Pulmonary hemorrhages are to all appearance not favored by absolute or relatively high blood-pressure even in such cases of pulmonary tuberculosis as are characterized by a special tendency to hemoptysis.

F. M. Pottenger<sup>5</sup> calls attention to some factors which alter the blood-pressure in pulmonary tuberculosis. He

summarizes them as follows:

1. Low blood-pressure in tuberculosis is favored by the action of the toxin, the disturbed action of the diaphragm, and, particularly as the disease becomes advanced, by the weakness of the heart muscle and the general wasting.

2. High blood-pressure is favored by the increase in the number of heart beats, the hypertrophy of the heart

and thickening of the arterial walls.

<sup>(5)</sup> N. Y. Med. Jour., Aug. 31, 1912.

Bacteriemia. Klara Kennerknecht<sup>6</sup> gives the following results of investigations as to the presence of tubercle bacilli in the circulating blood of children:

1. Tubercle bacilli were found in the blood in 109 of 120 children examined, or 91 per cent.; in all of 68 in which a certain diagnosis of tuberculosis could be made; in 18 of 20 children suspected to be tuberculous, or 90 per cent.; and in 23 of 31 children who had not been considered tuberculous, i. e., 74 per cent.

2. The direct demonstration of bacilli in the blood is of the greatest diagnostic value, superior to the v. Pir-

quet or the Moro reaction.

3. The bacilli are found in the very earliest stage of tuberculosis when clinical symptoms are still lacking. This finding confirms the idea that we have to do with a primary bacteriemia.

4. In guinea-pigs infected by intraperitoneal injection the most extensive changes were found in the lungs and bronchial glands, indicating that the disease had spread by means of the blood or the lymph-channels.

5. In the experimental animals tubercle bacilli were found regularly in the lungs, the bronchial glands, and the blood, and frequently in other organs even when

they showed no histologic changes.

6. Since tubercle bacilli circulate in the blood, the possibility of the disease being transmitted to the offspring through the placenta is presented. In a pregnant animal the bacilli could be found in the spleen, liver and placenta of the fetus which was already dead.

P. Ranström<sup>7</sup> found in 9 cases out of 36 that tubercle bacilli were present in the blood. All the positive cases belong to the third stage. As far as his material goes he believes it possible to draw the conclusion that the presence of tubercle bacilli in the blood is related to the occurrence of fever. In none of his patients who were free from fever could bacilli be demonstrated in the blood. Eight of the nine cases were submitted to necropsy, but in none of them could any generalized miliary tuberculosis be found. In his opinion the prog-

<sup>(6)</sup> Beiträge z. Klin. der Tuberkulose, B. 23, H. 2.
(7) Deutsche med. Wochenschr., Aug. 15, 1912.



nosis of cases with a positive finding of tubercle bacilli in the blood is unfavorable.

R. Hilgermann and J. Lossen<sup>8</sup> have investigated the occurrence of tubercle bacilli in the blood of phthisical

patients and conclude as follows:

1. In about one-fourth of the cases of pulmonary tuberculosis investigated, tubercle bacilli were found in the circulating blood, not only in advanced cases but also in some in which the disease was not very extensive. The number of bacilli found was, however, quite small.

2. No relation could be established between the presence of bacilli in the blood and rise of temperature.

3. The further course of the disease in patients with positive findings of bacilli in the blood appears to be less favorable than in those with negative findings. The presence of tubercle bacilli in the blood, however, cannot be regarded as an indication of a beginning generalized miliary tuberculosis, but in several patients, in spite of this finding, a duration of life of one year and over and an improvement in the general condition took place.

4. The inconstancy of the finding in cases in which the tuberculosis was certainly established by bacteriologic examination and the time-consuming technic unfit this method for a general diagnostic measure in doubtful

cases in which tuberculosis is suspected.

Mixed Infection. H. Kögel<sup>9</sup> has investigated the question of mixed infection in 17 cases of chronic pulmonary tuberculosis. He found only in 5 cases hemolytic staphylococci and in no case the *Streptococcus longus hemolyticus*. The finding of hemolytic staphylococci was constant in only one case of an acute caseous ulcerative phthisis, while in the other 4 cases of febrile caseous ulcerative pulmonary tuberculosis, staphylococci which produce hemolysis were found only temporarily. In these cases a connection between the type of fever and the presence of hemolytic organisms could not be established aside from the severity of the individual case. All other forms of chronic and acute pulmonary tuberculosis were free from hemolytic organisms in spite of the

 <sup>(8)</sup> Deutsche med. Wochenschr., May 9, 1912.
 (9) Deutsche med. Wochenschr., Nov. 9, 1911.

occasional high fever. The blood was constantly free from associated bacteria.

In 5 cases of cavernous tuberculosis of the lung anaërobic streptococci of the character of the Streptococcus anaërobius putridus were found. In all other cases no strictly anaërobic organisms were present. At any rate the extent of a chronic mixed infection in pulmonary tuberculosis is extraordinarily limited. It is much rather to be assumed that the saprophytes which are found in the lung acquire (in an advanced stage of the disease) the capability of penetrating the tissues in consequence of the lack of resistance of the body, and by means of the good soil in the tissues, decomposed or saturated with blood, acquire hemolytic properties

In a later article Kögel<sup>1</sup> gives the results of his investigation of mixed infection in tuberculosis and concludes that washing the sputum and the use of blood-plates are valuable methods for the investigation of a chronic mixed infection with reference to the diagnosis, prog-

nosis and treatment.

A. With Reference to Diagnosis:

1. The blood-plates can be used at the bedside and enable one to learn whether the blood contains germs or not, and if a puncture of a vein is made the opportunity may be taken to examine the blood for the tubercle bacilli. If associated germs are found in the blood, which is rare, we have to do with the final stage of the disease, the patient being almost always moribund. Cocci are very rarely found in the blood.

2. The blood-plates are well adapted to the differen-

tiation of the cocci found in the sputum.

3. Staphylococci are, to be sure, found as the exciters of a mixed infection in some cases of pulmonary tuberculosis, but as a rule only temporarily, as after pulmonary hemorrhage. They are found in agonal cases, but only in those of the caseous destructive type. They play a minor rôle in acute phthisis, although mixed infection with them does occur.

4. Streptococci occur more rarely than staphylococci in the washed sputum, usually accompanying the latter.

<sup>(1)</sup> Beiträge z. Klin. der Tuberkulose, B. 23, H. 1.

Streptococcus viridans, pneumococcus, or saprophytic streptococci, were found, but Streptococcus longus was always absent. It must be assumed therefore that in most cases of pulmonary tuberculosis streptococci are harmless saprophytes.

5. Anaërobic streptococci play a certain rôle since they are found in chronic cavity cases and in acute destruc-

tive cases.

6. A chronic mixed infection occurs in tuberculosis, but is very rare. The author warns against the diagnosis of mixed infection without thorough investigation of the individual case.

B. As to Prognosis: Hemolysis by the germs found in the sputum is a sign of bad omen, indicating death within a few months. Similarly hemolytic cocci in the blood are also of bad prognostic import, occurring only in the

last stages.

C. As to Treatment: Kögel recommends a prophylactic isolation of patients with mixed infection, especially those who show the presence of hemolytic cocci, in order to prevent the infection of others. Patients in the early stages should avoid dusty air and especially that infected with staphylococci or pneumococci, and particularly hemolytic staphylococci or streptococci. In this way the treatment at the sea-shore or in the mountains is of value, because of the purity of the air. The use of vaccines in cases where the infection is due to non-hemolytic cocci may be of value.

Termination in Cutaneous Emphysema. L. Bernard and A. Cain² report an unusual case of acute phthisis in a girl aged 14½ years which terminated by a subcutaneous emphysema resulting from the rupture of the alveolar walls. A striking feature of this case, which seems to confirm the findings of Ribadeau-Dumas and Rist, was the fact that, while the tuberculosis was quite general, an old cavity was found in the lower lobe of the right lung. It is the belief of the authors mentioned that in children the disease frequently begins in the

lower part of the lung.

While the pathogenesis of the emphysema is to be

<sup>(2)</sup> Prog. Méd., Aug. 17, 1912,

traced to a rupture of the walls of the pulmonary vesicles by some mechanical force, the authors recognize that some other factor must be evoked to explain the rarity of such an accident. What this factor is they are unable to state.

Bronchial Dilatation. Weill and Gardere<sup>3</sup> report cases in which tuberculosis has resulted in dilatation of the bronchi, but they add that this is a rare event. It is much more frequently the case that syphilis is the active agent; however, it is interesting to know that the anatomic lesions of these two infections may resemble each other.

Peribronchial Phthisis. In the Practitioner February, 1912, A. C. Jordan gave an account of peribronchial phthisis, and showed that phthisis is not, as ordinarily supposed, a disease of the apices of the lungs, but is, in the majority of cases, a disease of the roots. He supported his contention with figures, illustrations and arguments which seemed irrefutable, and although the paper aroused much comment, most of the opinions have been favorable to its views, the adverse criticism consisting, for the most part, of expressions of doubt as to the statements of fact: for example, as to the frequency with which phthisis starts at the hilus. Some admit that phthisis may start at the hilus in the case of children, but they give no reason for presupposing a different pathology for adults.

Jordan showed that in all "healthy" lungs there are shadows at the hilus, consisting of blotches and radiating lines, which are pathologic in origin, being due to obsolete tuberculous infection, and to the reaction set up in tissues to render the tubercle inert. These shadows show that there can be very few persons above the age of 6 years who have escaped calcareous deposit in the lungs. In the great majority of the cases (25 cases out of 36) there were gross deposits of calcareous matter in the bronchial glands or elsewhere; in the rest there were small calcareous fragments, and in many there was a

<sup>(3)</sup> Lyon Méd., June 2, 1912.
(4) Brit, Med. Jour., Aug. 31, 1912,

large excess of fibrous tissue arranged in thick strands or sheaths around the main branches of the bronchi.

The calcareous deposits represent obsolete tuberculosis, and the fibrous tissue around the air-tubes represents

healed tuberculous bronchopneumonia.

A large number of sections of the hilus shadows of some of these "healthy" lungs have been cut and stained; they indicate beyond the possibility of doubt that these shadows are tuberculous in nature. The appearances in some cases are practically indistinguishable from those shown in sections of an ordinary case of very chronic phthisis. There are typical tuberculous bronchopneumonic patches with small round cells and large endothelioid plates, there are extensive tracts of dense fibrous tissue, and there are the calcareous patches already referred to. A positive tuberculin reaction is obtained, by the most delicate test, in 94 per cent. of all children between the ages of 11 and 14, and in most The presence of actual foci of tuberculous bronchopneumonia or of tuberculous glands in the roots of the lungs may readily account for this. The glands and other structures at the hilus have to deal with a continuous tuberculous invasion throughout life. are able to cope with the invasion, but in the case of some the tissues are not able to offer effective resistance, or the tissues are receiving a greater number of tubercle bacilli than they can destroy; these become the subjects of pulmonary tuberculosis.

In every case the invasion takes place by way of the hilus. The author's former paper showed that in at least 40 per cent. of cases of phthisis the disease commences as definite peribronchial mottling. From the hilus the disease spreads in all directions, but most rapidly along the ascending and descending branch of the main bronchus. Sooner or later the disease reaches the apex (by way of the ascending bronchiole); it then appears, clinically, to be the chief seat of the invasion. Very often no physical signs are obtained until the apex has become infected, the disease at the hilus being so deeply placed as to escape detection from without.

In about 20 per cent. of cases of phthisis the tubercu-

lous infection travels up along the main ascending bronchiole to the apex at an early stage, and the disease progresses at the apex, while the track of the infection from the root heals, leaving only an excess of fibrous tissue around the ascending bronchiole. These are the purely apical cases of phthisis.

In his former paper Jordan referred to "fibroid phthisis" and to "chronic fibrosis" as though they were merely the most chronic cases of pulmonary tuberculosis of the peribronchial type, in which much fibrous tissue is formed in an attempt to limit the tuberculous invasion. He further stated that bronchiectasis is usually indistinguishable, radiographically, from "fibroid phthisis," bronchiectasis being apparently merely a special form of "fibroid phthisis" in which the air-tubes have become dilated. This has been taken to amount to an assertion that chronic fibrosis is always necessarily due to tuberculosis. Jordan would not make so unqualified a statement, though he is fully convinced that this is the case in the vast majority of instances. Now and then an attack of acute pneumonia in a previously healthy person leads to a form of chronic fibrosis, which appears to be non-tuberculous at the outset, although eventually tubercle bacilli are very likely to appear in the sputum. The distribution of the lesions in such a case may be found atypical on x-ray examination. Jordan reports the autopsy of a fairly typical case with tuberculous lesions.

Thus the last link in the chain of evidence of peribronchial phthisis has been forged; a well-marked case has been examined pathologically and histologically, and absolute proof has been offered for the contention that a very important form of phthisis is that which commences at the roots and spreads thence in a radial manner in all directions, but most rapidly along the larger air-tubes.

The results of the examination by the x-rays and the microscope of a large number of "healthy" lungs leads to the incontrovertible conclusion that the hilus is the ordinary place of entry of the tuberculous lesion in pulmonary phthisis, and that the ordinary route to the apex is along the air-tubes from the hilus.

The reason the apex has hitherto been considered to be the starting place of the disease is due chiefly to two facts: First, that physical signs of phthisis are easily detected at the apex, where the diseased part is close beneath the surface, while the hilus is placed deep in the chest and has a considerable thickness of healthy lung over it in the important early stages; secondly, that the disease, once it has extended to the apex, is apt to advance very rapidly in this region, while the disease at the hilus is far more apt to undergo cure with the formation of calcareous deposits and of fibrous tissue around the air-tubes.

The practical importance of the conclusions is paramount. The x-ray method enables the disease to be recognized in its early stages, wherever the situation of the lesions. The bacteriologic diagnosis is then obtained in confirmation of the x-ray findings, and the patient is placed under appropriate treatment. On the whole the peribronchial form of phthisis is more chronic and more apt to undergo cure by calcareous and fibrous change than is the apical form.

Finally, the recognition of the nature and meaning of the so-called "normal hilus shadow" renders the x-ray examination of the lungs rational, and clears up a great many discrepancies and difficulties of interpretation and

diagnosis.

Emphysema. O. Orszag<sup>5</sup> reaches the following conclusions with reference to the relation of emphysema at the apex to pulmonary tuberculosis: A circumscribed emphysema may occur at the apices of the lungs and the possibility of its presence must be borne in mind by physicians in the examination of tuberculous individuals. It may render the recognition of the pathologic relations difficult. The area of pulmonary resonance of Krönig is not contracted in all cases of apical disease. It may be increased in case of emphysema at the apex or of cavities, relaxation and pneumothorax. The decrease in intensity of the sound on percussion at the apex of the lung is not necessarily a sign of reduction of the infiltration, for it may be the consequence of an

<sup>(5)</sup> Berlin, klin, Wochenschr., Oct. 14, 1912.

emphysema. In examining the apices of the lungs one should employ not only the light and comparative percussion but also stronger percussion of varying intensity.

P. Bahr and G. C. Low report a case of tuberculosis in which the left ventricle, even more than the other chambers of the heart, was greatly diminished in size owing to an enormous, more or less concentric, hypertrophy of the ventricular wall. The myocardium was replaced by caseous, cheesy masses of different sizes, these having produced the nodular or marble-like lumps seen on the outside of the heart during the necropsy. The wall at the base of the ventricle measured no less than 13% inches in thickness, this gradually tapering to 3/4 inch at the apex. Practically no normal muscular tissue was left, the tuberculous lesions having entirely replaced this. The right ventricle and both auricles were also affected, the cavity of the left auricle especially being surrounded and infiltrated by tuberculous masses and thereby greatly obliterated. Remains of the pericardium, adherent and firmly bound to the auricles and great vessels at the base, were easily found, but the pericardial membrane was, on the whole, quite free from tuberculous changes.

N. G. Seymour reports a series of 126 cases of cardiac disease occurring among 2,151 admissions to Gouveneur Hospital Tuberculosis Clinic. While he does not present positive conclusions, he calls attention to two significant facts: first, that one of the most frequent errors encountered in diagnosis is that of pulmonary tuberculosis in cases of uncomplicated chronic endocarditis; and, secondly, that the combination of these two conditions is not very unusual, and, therefore, the recognition of an undoubted heart lesion does not preclude the possibility of a coexistent tuberculosis of the lungs.

Narins's reports a number of cases of tuberculosis complicated by mitral stenosis and states that the evidence points to the conclusion that the passive congestion of the lungs, due to the mitral stenosis, acts in a favorable way on the tuberculous process in the lungs,

<sup>(6)</sup> Lancet, Feb. 10, 1912. (7) N. Y. Med. Jour., Sept. 21, 1912. (8) N. Y. Med. Jour., Sept. 21, 1912.

Peritoneum. According to J. B. Murphy<sup>9</sup> the atria of invasion of the peritoneum in tuberculosis may be classified as follows: (a) through the female genitalia; (b) through the alimentary tract; (c) through the subperitoneal lymphatic glands; (d) through diffuse general miliary tuberculosis—through the blood-stream.

Tuberculosis of the peritoneum is more commonly secondary to the tube than to any other primary lesion. Tuberculosis of the mucosa of the tube is reparative and does not completely heal, but in the large percentage of cases that have come under his observation it does not heal spontaneously until the fimbriated end of the tube is closed. Tuberculosis of the endosalpinx is the only type of infection of the tube that continues with the abdominal atrium or fimbriated end open. In all other varieties of infection of the tube the fimbriated end becomes rapidly sealed and adherent to the neighboring structures, but in simple tuberculosis of the tube it remains open, repeatedly ejecting tuberculous débris into the peritoneum. In unmixed infection the tube remains open, accounting for the recurrent attacks of peritonitis we have as a result of that form of invasion. Except in rare cases tubal tuberculosis is primary and that of the ovary secondary.

As to the frequency of direct infection of the peritoneal surface by perforation through the walls of the appendix, the caput coli, the large intestine, stomach and duodenum Murphy believes it practically never occurs. The appendix and cecum are most commonly infected and their coverings are invaded from beneath.

From a pathologic standpoint we may divide tubercu-

losis of the peritoneum into three classes:

1. The catarrhal variety, in which there is a great amount of effusion, with deposits of tubercle on the surface.

2. The agglutinated variety, where we have slimy, cobweb adhesions so characteristic and typical of tuberculous peritonitis.

3. The circumscribed, encapsulated, caseous variety, in which there is liquid tuberculous débris, with destruc-

<sup>(9)</sup> Ill. Med. Jour., March, 1912.

tion of the peritoneal coat of the bowel, and circumscribed organic encapsulations always resulting in permanent peritoneal adhesions. It is impossible in this variety to tell where the primary infection came from in a large percentage of the cases.

Murphy has never seen tuberculosis of the stomach, nor has he had a case of tuberculosis of the duodenum. There may be extensive tuberculous disease of the ileum, cecum and appendix, but the disease seldom spreads

from these organs to the peritoneum.

As to the diagnosis of tuberculous peritonitis, it can be made in a considerable percentage of cases. From Murphy's experience it is easier to make the diagnosis in the female than in the male. The thickened leathery condition of the Douglas pouch is one of the striking signs of this disease in the female. There is no fixation of the tubes such as there is in ordinary gonococcic salpingitis. A doughy resistance of the abdomen is very common, together with a doughy reaction of the abdominal skin after twisting (Deck's sign). The tuberculin reaction aids one materially in making the diagnosis. Circumscribed flatness in encapsulated tuberculosis of the cystic type assists in the differential.

With regard to the *treatment* of tuberculous peritonitis as it comes under our observation; even where the tube is patent, medical means should be resorted to. We do not open the abdomen any more or at least as frequently as we formerly did, but give the patient tuberculin, developing a constitutional condition favorable to the repair of the tuberculosis. No tissue in the body undergoes repair from tuberculosis so readily as the peritoneum, provided the source of tuberculous débris supply

is cut off.

In the cystic variety an opening is made for the purpose of relieving fluid tension and inserting some irritant which induces an inflammatory tissue reaction and polynuclear cytosis in the cavity, such as iodoform, camphor oil, Venice turpentine, etc.

In the third degree of tuberculosis the surgery is that of masterly inactivity. The greatest improvement in results has been made through a properly administered

tuberculin treatment. There is no medicament in the entire range of therapeutics where the patient's individual equation must be so accurately estimated and tested to obtain the best results as in the administration of tuberculin. The negative opinions on the value of tuberculin are based: (1) on a defective knowledge of the rôle of opsonins in the process of repair; (2) on evil results obtained through improper administration of the remedy; and (3) on assumed superior judgment with neither knowledge nor experience to support it. The dosage must be studied in each individual case, as one patient may be given 10,000 times the dose of another and the larger dose be too small and the smaller dose be too large to obtain the best opsonic result.

Intestinal Tuberculosis. According to A. Bretschneider1 the blood-changes in connection with tuberculosis have usually been of an insignificant character. Pallor is a common symptom, but the result of careful examination of the blood has usually shown merely a moderate reduction in the red corpuscles and hemoglobin. of the character of a secondary anemia. There is usually a tendency to an increase in the relative number of mononuclear white cells, but not such as to give a pronounced picture of leukemia. In rare cases there has been observed the occurrence of blood-changes justifying the characterization of pernicious anemia. some other cases a pronounced leukemia has been ob-The latter has of late been brought into closer relation with tuberculosis, inasmuch as Much and Fraenkel, in a number of cases of lymphatic leukemia, have found the granular form of tubercle bacillus, and this finding has been repeatedly confirmed.

Bretschneider reports two cases of blood-changes in connection with tuberculosis of the intestines which for a long time gave the impression of being essential blood-diseases, but in which, after clinical observation, or only by the autopsy, a latent tuberculosis of the intestine and its lymphatic glands was found to be responsible for the origin of the striking blood-picture. In the first case, aside from the tuberculous lesions, there was a very

<sup>(1)</sup> Berlin. klin. Wochenschr., Dec. 11, 1911.

severe anemia which must be regarded as pernicious on account of the changes of the red blood-cells. leukocytes, however, showed changes which ordinarily are not to be found in the picture of pernicious anemia. Particularly the high number of myelocytes and the ungranulated cells of the bone-marrow produced a symptom-complex which may be designated as leukanemic; and, indeed, was brought about by an especially severe reaction of the leukoblastic apparatus in the bone-marrow. This plays an especial rôle, according to the recent investigations of Naegeli, Meyer and Heinicke, in cases of typical pernicious anemia, and often causes the changes in the erythroblastic tissue to assume a minor importance. It may be assumed in such a case that the erythroblastic apparatus was quite destroyed, while the tissues forming the white cells underwent proliferation. but, as shown by the poorly developed cell-forms in the blood, was already markedly injured.

In view of the rarity of the changes characterizing pernicious anemia in tuberculosis it becomes a pertinent question whether the affection of the blood-making organs was not due to poisonous substances absorbed through the intestinal mucous membrane. This may have been

to some extent a condition of mixed infection.

Pancreas. M. Loeper<sup>2</sup> calls attention to the rôle of the pancreas in tuberculosis, and notes that pancreatic insufficiency in the tuberculous is shown most frequently by diarrhea, a large number of the cases of diarrhea in tuberculous patients having only an indirect relation with the tuberculosis and often deserving the name of dyspeptic diarrheas. The diarrhea is not simply qualitative but quantitative, for it results from a marked acceleration of the passage through the digestive tract rather than an intestinal hypersecretion, and the weight of the feces may exceed 200, 300 and even 400 gm. It is frequently accompanied by putrefaction and pain and is likely to be intractable, being little influenced by the ordinary remedies such as bismuth, lime water and opium. It is especially characterized by the presence of large amounts of residues of food such as fat, muscu-

<sup>(2)</sup> Prog. Méd., Sept. 23, 1911.

lar fibers, and starch granules. While pancreatic insufficiency is often indicated by diarrhea, it may be accompanied by no apparent digestive troubles. There is then an emaciation out of proportion to the pulmonary lesions, and sometimes a little sugar in the urine, which enables one to make a diagnosis which is confirmed by an examination of the feces.

In contrast with insufficiency of the pancreas there exists a condition of increased function which appears not to be rare at the beginning of tuberculosis. According to Loeper, the signs of this increased function are the following: A good appetite, almost a boulimia, and still marked emaciation; an increase of the amylase in the blood and also in the urine; the presence in the urine of a proteolytic ferment which can be precipitated by alcohol and is active in an alkaline medium, thus corresponding to trypsin; sometimes a transient glycosuria following a meal. Loeper has observed a marked indicanuria in spite of the absence of diarrhea: an increase of the ethereal sulphates in spite of the absence of intestinal fermentation; a marked Cammidge reaction; and the presence in the feces of a very abundant and active amvlase.

Tuberculosis of the pancreas is not very common, but the changes that occur indicate a congestion and infiltration in the earlier cases, followed later by degeneration, frequently fatty, and by sclerosis which usually affects the islands of Langerhans. Tuberculosis acts on the pancreas more than any other affection. The author has shown by animal experiments that there exist two anatomic types of tuberculous pancreas; the one which is met, it seems, at the beginning of the disease and which indicates a hypertrophic reaction; and the other which belongs to cases of tuberculosis of longer duration, and points to a degeneration and a sclerosis or an atrophy. The author believes that these changes are not merely of theoretic importance but that one should be on the lookout for evidences of insufficiency of the pancreas in the later stages of the disease, and endeavor to stimulate its activity or to supplement the lack of its functions by the use of the artificial ferment,

Complications. Diabetes. From an investigation of the relative frequency of tuberculosis in diabetes C. M. Montgomery<sup>8</sup> concludes as follows: That tuberculosis occurs more frequently in diabetes than in the general population at the same age periods has not been definitely proved by the evidence collected by the writer. However, one is impressed by two facts: (1) The lowered opsonic index to the tubercle bacillus and a number of other bacteria in diabetes; and (2) the large number of cases of diabetes late in the course of the disease developing a very acute, extensive and rapidly fatal form of pulmonary tuberculosis. Tuberculosis occurs more frequently in diabetes than in some other chronic diseases. The frequency of tuberculosis in diabetes varies with a great variety of different circumstances. In the writer's 25 collected autopsies on diabetic patients 6 showed active pulmonary tuberculosis, varying in acuteness and extent of involvement, and 1 showed adrenal tuberculosis without tuberculosis elsewhere. Out of 355 autopsies collected from the literature since 1882, including also the writer's 25 cases, 138 (38.9 per cent.) revealed pulmonary tuberculosis, mostly in an acute form. In some structures, for example, the bones, the writer could not find a single case of tuberculosis in a diabetic patient.

The frequency of diabetes in cases of tuberculosis is fairly well represented by the table presenting 31,834 cases of pulmonary tuberculosis, of which about one-third of 1 per cent. had glycosuria, and between one-sixth and one-third of 1 per cent. had diabetes. Five cases of diabetes were found in 937 autopsies on tubercu-

lous patients.

When diabetes and tuberculosis are associated the diabetes can usually be shown to be the primary disease. In a number of cases it is impossible to show which is the primary disease, and in no case that the writer has encountered has the tuberculosis been definitely proved by the evidence furnished to be the primary disease. When diabetes and tuberculosis are associated in the same patient either disease may show certain modifications in course and symptomatology, but often each

<sup>(8)</sup> Amer. Jour. Med. Sciences, October, 1912.

disease runs a course apparently independent of the other.

Like the clinical course the autopsy findings may reveal nothing unusual in regard to the tuberculosis, but in a number of cases one meets a tuberculous process that is marked by acuteness, extensiveness of the disease, and tendency to the early development of cavity formation.

From the number of cases that have improved both as to their tuberculosis and their diabetes, one cannot consider the combination of diabetes and tuberculosis as necessarily more hopeless than the diabetes or the tuberculosis alone. The prognosis in many cases depends largely on the treatment.

Investigation is Acceptinually, throwing more or less doubt on some of the newer methods of diagnosis of disease in the chest. The tuherculin reaction, as will be seen from some of the abstracts presented, must be regarded as of little value for the determination of tuberculosis in the adult. The ordinary microscopic examination for tubercle bacilli may fail to recognize conditions in which tubercle bacilli of the form of Much granules are being excreted in considerable quantities. A careful consideration of the clinical history and careful physical diagnosis of the chest must be placed first in importance in making a diagnosis of pulmonary tuberculosis.

Failure to Make Early Diagnosis. One of the striking facts presented by the reports of sanatorium physicians is that cases are sent for admission in advanced stages of the disease which have frequently been incorrectly diagnosed when the patients first consulted their physicians. G. W. Beach presents some explanations as to why the general practitioner does not more frequently recognize pulmonary tuberculosis in its incipiency. It is shown by the experience of sanatoriums that some general practitioners are incompetent to distinguish ad-

<sup>(4)</sup> Med. Record, Oct. 5, 1912.

vanced tuberculosis from the incipient stage, and the author discusses some reasons why even competent physicians neglect to take the proper means for making a correct diagnosis. It is not uncommon for the general practitioner to fail to have his patient stripped to the waist for a chest examination. He often takes too little time and makes but one examination, when that has left him in uncertainty. The existence of tuberculosis is frequently denied, because negative bacteriologic findings are reported. Other faults lie with the public, the medical schools and the patients themselves.

J. B. Hawes discusses the question: Is the early diagnosis of pulmonary tuberculosis being carried too far? The following reasons are frequently given in favor of a conservative attitude: 1. Many wrong diagnoses are being made, and as a result many non-tuberculous patients are being sent to sanatoria and health resorts. 2. Such patients in whom wrong diagnoses are made and who are sent to a sanatorium run a grave risk of catching tuberculosis. 3. Furthermore, it is a great iniustice and source of hardship and injury to place on any one who does not deserve it what is called "the stigma of tuberculosis." 4. A few hold the view that a diagnosis of tuberculosis is rarely justified unless bacilli are present in the sputum. 5. It is not right to "break up the family" and send away the bread-winner, etc., unless the evidence is positive, and by the term "positive" is meant "positive sputum."

To which Hawes replies: 1. Very few wrong diagnoses are made in calling patients tuberculous when they are not so, while the reverse is true to an alarming extent. 2. There is no danger of catching tuberculosis in properly managed sanatoria. 3. The "stigma of tuberculosis" is more a term than a fact, and no harm either physical or social is done to patients sent to a tuberculosis sanatorium because of a wrong diagnosis. 4. The best authorities agree that early diagnosis must be made before there is a positive sputum. 5. It is not only right to "break up the family" and send away the bread-

<sup>(5)</sup> Boston Med. and Surg. Jour., June 20, 1912.

winner if there is good reason to believe that he has tuberculosis, but also wrong and unjust not so to do.

The wrong positive diagnosis is made in about 0.4 per cent. of cases, while many patients are sent to sana-

toria too late because of ultra-conservatism.

Obscure Tuberculosis. According to the definition of W. B. Metcalf, obscure tuberculosis denotes a condition presenting a chain of symptoms that do not suggest tuberculosis, but that show a positive febrile reaction to the subcutaneous tuberculin test. Tuberculosis exists long before it can be detected by physical signs and symptoms. The time between implantation and the time of demonstration by physical signs and symptoms may be many months and in some cases it is many years. It is during these early days of the disease that the cure will cost the least. We must discover it before the appearance of physical signs. It may be stated as a truism that according to current medical usage much is denominated disease which is in reality only an effect of the same, and that many coexisting organic disturbances in the same body are looked on as separate and independent disorders which on investigation are found to form a group of superficial manifestations which owe their origin to a common underlying cause—tuberculosis.

[While the tuberculin reaction does not of necessity indicate active tuberculosis, it does indicate a tuberculous individual, and it should warn such an individual, especially if his family or personal history presents evidence of past tuberculosis, to take especial precautions against the development of the disease. In such cases due regard should be had to the symptoms of scrofula, especially in the nose, throat, skin and joints. The diagnosis of rheumatism should not be made in such cases until the existence of a tuberculous arthritis can be satisfactorily excluded.—S.]

The Diagnosis of Tuberculosis of the Pleuræ and Lungs. F. W. Price gives the following characteristics of tuberculous pleurisy: Tuberculous pleurisy most com-

<sup>(6)</sup> Ill. Med. Jour., July, 1912.
(7) Brit. Med. Jour., Feb. 10, 1912.

monly occurs at the apex of the lung. Dry pleurisy limited to the axillary region or to the base of one lung is undoubtedly often non-tuberculous. Dry pleurisy limited to one apex is, in the absence of croupous pneumonia, almost certainly tuberculous. Bilateral dry pleurisy, or one that is widespread over the lung, is, in the absence of new growth, probably tuberculous; and quite two-thirds of the cases of pleurisy with effusion have the same cause, especially when, on microscopic examination of the fluid, the cells are found to be lymphocytes, in contrast to polynuclear leukocytes.

Physical Signs of Pulmonary Tuberculosis. Although the symptoms are important, it is on the early detection of physical signs that the early diagnosis of pulmonary tuberculosis mainly rests. Price lays down two broad

principles of vital importance:

1. The locality of the physical signs. In the great majority of cases the primary seat is from 1 in. to 11/2 in. below the summit of the lung (rather nearer the posterior and external borders). A less common primary seat is in the second and third interspaces below the outer third of the clavicle. The lower lobe of the same lung is usually affected early. The common primary seat of the lower lobe is from 1 in. to 11/2 in. below its summit, that is, opposite the fifth dorsal spine, midway between the spinous process and the vertebral border. then spreads along the line of the vertebral border of the scapula. This early affection of the apex of the lower lobe is of immense value in differential diagnosis. Occasionally a "crossed lesion" is found, that is, the lower lobe of the opposite lung is involved before that of the side primarily affected. The supraclavicular and infraclavicular regions, the supraspinous fossæ, and the interscapular regions opposite the fifth dorsal spine should always be very carefully examined.

Primary basal tuberculosis, apart from the pneumonic type, is very rare, and when it does exist there has usually been some antecedent damage sustained, as, for example, by pleurisy. What is called primary basal tuberculosis is often secondary to an apical lesion, which,

because it has healed, or for other reasons, has been overlooked.

[In children, however, some authors believe that the upper portion of the lower lobe is a favorite seat for

primary infection.—S.]

2. A diagnosis of pulmonary tuberculosis from one single physical sign should never be made. Considerable variations from the normal are often met with in perfectly sound chests. As an example of this fundamental and all-important rule may be cited the fact that if distinct impairment of the percussion note is discovered at one apex, it should, if pathologic, be accompanied by other physical signs, such as diminution of expansion, or alteration in the vocal fremitus or breath sounds; otherwise it may be merely indicative of curvature of the spine. Similarly, the mere presence of bronchial breathing may be due to an abnormal position or course of a bronchus; but when such breathing is pathologic, the lesion which gives rise to it is always sufficient in degree to cause some other physical sign or signs. On the other hand, several slight abnormal signs, which when taken separately are of no pathologic significance, if they all point in the same direction, afford just grounds in making a positive diagnosis.

Another point of importance is to compare exactly corresponding points on either side. It is best to have the patient stripped to the waist, seated or standing, in a good light, and to adopt the usual plan of inspection,

palpation, percussion and auscultation.

One clavicle may be seen to stand out more prominently than the other, and there may be some hollowing of the fossæ above and below; but these, and also displacement or uncovering of the heart, are evidences of fibrosis, which is a secondary change, and are not found in the very early stage of the disease.

Diminution of expansion at one apex is a very early sign. It may be observed by standing in front of the patient, or sometimes it is better observed by standing behind and looking down the front of the chest from above. There are various ways of noting it by palpation. The thumbs may be placed on the second ribs

below the clavicles, the eyes being fixed on the thumbs when the patient takes a long breath; or the hands may be placed below the clavicles; or, standing behind the patient, the thumbs may be placed in the supraclavicular and the fingers in the infraclavicular regions, or the hands on the shoulders close to the neck, the fingers lying over the clavicles touching the infraclavicular areas and the thumbs lying on the supraspinous fossæ.

Diminution of expansion at one apex is of great significance and is a very early sign. It is almost always found before any alteration in the percussion note and frequently as soon as any change in the character of the breath sounds. It may amount to only a slight lagging of movement behind that of the other side. If it merely indicates a localized thickening of the pleura without any lesion of the underlying lung, this apical pleurisy is almost always tuberculous. Normally the vocal fremitus is as a rule greater on the right side than on the leftalmost certainly in more than 75 per cent. of cases. If it is found to be equal on both sides and well marked. there is probably some disease in the left upper lobe. If it is more marked, the probability is still greater. If the fremitus is equal on both sides but less apparent than normal, it almost certainly means some diminution at the right apex, and this signifies that at that part there is either a thickened pleura, a pleural effusion, or some localized emphysema. This localized emphysema is most frequently due to a deeper tuberculous lesion. Any changes in the vocal fremitus in the supraspinous fossæ have the same significance.

In bronchial breathing the inspiration is blowing in character; the pitch is higher than in vesicular; there is a distinct interval between inspiration and expiration; the expiration is still more blowing and has a still higher pitch, and has an equal or longer duration than inspiration. In true bronchial breathing the expiration should be blowing, and have a uniform pitch and intensity through the whole act. Bronchial breathing is normally heard over the seventh cervical spine, and this locality should always be taken as the standard. Bronchovesicular breathing, in which the characters of bronchial

are combined with those of vesicular breathing, is heard normally over the manubrium in front and the upper

part of interscapular region behind.

It is of the utmost importance to distinguish between the intensity and quality of the breath sounds. Negligence in this is one of the commonest sources of errors. Regarding the intensity of vesicular breathing. even in normal conditions there is a very great range of variation. In one chest it is very loud, in another it is quite faint. Pulmonary tuberculosis has frequently been diagnosed by mistaking harsh vesicular for bronchial breathing. The error can easily be avoided by comparing one side with the other; it is bilateral. Bronchial breathing should be diagnosed by the quality and not by the loudness of the breath sounds. But even here it should be remembered that normally the breath sounds on the right side are of slightly higher pitch, and the expiration is rather prolonged; beneath the right clavicle they may be even bronchial, and this has occasionally led to the diagnosis of consolidation or of a vomica in a healthy person. It is sufficient to note the absence of corroborating physical signs. Cog-wheel breathing, when heard equally over the whole of one lung, is of little significance; when limited to one apex it may be of diagnostic value, but even then it is by no means reliable, as it may be caused by irregular muscular contraction. Harsh breath sounds, with prolonged expiration, limited to an apex, is generally the earliest auscultatory sign of pulmonary tuberculosis. There may be merely prolongation of expiration. If so, what we infer from it depends entirely on its character. If it is only faintly blowing and of low pitch it probably indicates emphysema: if it is truly blowing and of high pitch it usually means infiltration.

A marked diminution of the respiratory sound at one apex, especially the right, if persistent on repeated examination, is, in the absence of a localized condition of emphysema, thickening of the pleura, pleural exudation, or bronchiectasis in which the bronchus is plugged, extremely suspicious.

Adventitious sounds, when present and correctly

understood, are probably of greater help in the early diagnosis of pulmonary tuberculosis than any other physical sign. First of all, get the patient to cough and to breathe deeply, for frequently these acts are accompanied by râles which are inaudible in quiet breathing; and, conversely, the significance of accompaniments often depends upon whether they disappear on deep breathing

and on coughing.

Oral Auscultation. K. Takata<sup>8</sup> describes his method of oral auscultation, which consists in the examiner listening with a stethoscope held in front of the open mouth of the patient, who breathes slowly and noiselessly, as deeply as possible, exclusively through the mouth. He says that the circumstances under which oral auscultation may be applied are the following: 1. In the self-examination of bronchitics or patients with diseases of the lung as to the presence or absence, and the increase or decrease of râles. The author advises that the laity be instructed to distinguish these sounds from noises formed in the pharynx and thus to recognize the gravity of a lesion in which they are observed. 2. This examination may be made use of on occasions when it is not practicable to remove the clothing. 3. It may be applied in patients whom it is undesirable to turn in bed. 4. It makes possible the discovery of râles in cases in which they cannot be heard through the walls of the chest; for instance, in cases of central pneumonia. 5. It is a rapid method applicable when a large number of patients are to be examined. 6. It may be used to control the findings of ordinary auscultation.

Vesicular Murmur. F. Bezanson<sup>9</sup> reviews the literature and gives his own observations with reference to the diminution of the vesicular murmur at the apices of the lung. While there is no physiologic reason for a difference in the murmur at the two apices, the nasal obstructions which lead to a diminution of this sound usually produce it most markedly on the right side, indicating that the right apex is peculiarly predisposed to collapse. This diminution of the respiratory murmur is

 <sup>(8)</sup> Berlin. klin. Wochenschr., Jan. 8, 1912,
 (9) Presse Méd., Aug. 3, 1912,

commonly due to adhesions or tuberculous lesions in the immediate neighborhood. Sometimes these may be latent affections of the pleura or bronchial glands, but the sign may be found also in patients with fully developed tuberculosis. It may occur, as has been said, from nasal obstruction.

In the presence of a diminished vesicular murmur localized in one apex the physician should consider first of all the existence of a tuberculous lesion. He ought to search with great care for the signs of bacillary infection and make repeated examination of the mucus expectorated by the patient even when it seems to come simply

from the pharynx.

In the absence of any positive proof of active tuberculosis it is still important to consider that there may be either an aborted tuberculosis, according to the idea of Bard, or a latent form of the disease, but of such character that it is likely to be reawakened and consequently necessitate, even in the absence of any definite indication of tuberculous infection, an attentive surveillance on the part of the clinician.

X-Ray Signs. According to B. Knobel, deficient illumination of an apex by x-rays is the most constant and therefore the most important sign of active phthisis. Moreover, when one is equally experienced with the fluorescent screen and the physical methods of examination it is easier to detect differences between the two

sides by seeing than it is by hearing.

In his experience the most marked change in the signs as the result of treatment is the illumination of the apex, and perhaps the whole lung, by x-rays. In cases where a definite shadow is present at the apex, with poor illumination before treatment, at the end of treatment the shadow is still there, but with much better illumination round it. The better the illumination of the apex, the earlier and more easily detectable are the local signs of improvement. Even in much more advanced cases with considerable shadowing, with improvement in symptoms and general signs, there is improvement in

<sup>(1)</sup> Brit. Med. Jour., Oct. 14, 1911.

the illumination of the portions of the lung not covered in shadow.

While Knobel has seen considerable improvement, and, in some very early cases, the disappearance of the x-ray signs where they may have been well-marked at the beginning, he has not seen them altogether disappear with treatment; and it seems reasonable to suppose that impaired function due to toxins is followed for a time by impaired function due to disease or habit.

The presence of a small shadow is by itself of no value whatsoever in the diagnosis of phthisis, for by the diagnosis of phthisis one means the diagnosis of what is called active phthisis. If a shadow is present before treatment, it will be present after treatment when the patient is cured. It may be somewhat altered, but it will still be a definite shadow. If one examines a radiograph of a chest which shows a shadow in the lung. except in the case of certain comparatively rare conditions, one can definitely say that the patient of whom the radiograph was taken has or has had phthisis. But one could not possibly say what condition that patient was in as regards immunity to tuberculous infection. One could not say whether the plate had been taken before or after treatment. Where there is extensive shadowing one can say that the case must be one of advanced phthisis, and where there are small, coarse, discrete shadows one can say that the case is one of healed phthisis and the shadows caused by calcareous nodules. In the ordinary length of time—three to six months in which one can "cure" moderately early cases of phthisis, the author has not seen much alteration in the shadows. In more advanced cases one sees dense shadows become lighter in parts from the formation of cavities, and the walls of cavities become denser after treatment.

The great value of radiographs in phthisis is to give one an accurate picture of the extent of disease that is capable of casting a shadow. Every other sign of phthisis is better observed on the screen. Two radiographs taken of the same case before and after, say, three or six months' treatment, may show slight differences in the shadows, and any alteration in the slope of the ribs, but it is not easy to show differences in illumination. The deficient illumination of an apex, which may be quite apparent on the screen, is often not shown on the plate, owing to the more penetrative rays used for photographic purposes and the length of exposure. And, further, any alteration in the movements of the diaphragm can, of course, only be observed on the screen. For these reasons the most valuable method of using x-rays for the diagnosis of phthisis and for determining the results of treatment is examination with the fluorescent screen.

Pottenger's Sign. F. Raether<sup>2</sup> reports examinations of the scaleni muscles in cases of pulmonary tuberculosis, which examinations fail to confirm the view of Pottenger that the spasm and rigidity of these muscles, which have been noticed by him as a sign of phthisis, are accompanied by organic changes in the muscle fibers, such as destruction of the muscular tissue, obscurity or disappearance of the striations. He found well-marked degeneration of the cardiac muscle in both acute and chronic cases, but in neither of these classes of cases was there a similar change in scaleni muscles. There were some instances of fibrous change, but evidently unconnected with the spasm or rigidity described by Pottenger.

Examination of the Sputum. Respecting the value of sputum examination F. W. Price<sup>3</sup> emphasizes the usual sufficiency of the clinical history and physical signs before bacilli are found in the sputum. The examination of the sputum is of very great service in those patients who suffer from bronchitis and emphysema. Indeed, as a means of diagnosis of early pulmonary tuberculosis it is of far greater value in this class of patients than in younger people, for the physical signs of the primary disease frequently mask the presence of a tuberculous lesion, except in its later stages. Consequently the sputum should be examined periodically and as a matter of routine in all cases of emphysema and

<sup>(2)</sup> Deutsche med. Wochenschr., July 4, 1912, (3) Brit. Med. Jour., Feb. 10, 1912,

associated bronchial catarrh. It should be remembered that pulmonary tuberculosis in elderly people is fairly common. When tubercle bacilli are found in the expectoration, and we are able with certainty to exclude tuberculosis of the mouth, pharynx and larynx, a diagnosis of pulmonary tuberculosis should be made, even in the absence of symptoms and of physical signs. In Price's opinion hemoptysis is not so common a mode of onset as is frequently supposed.

Price adheres to the following rule. If it is a case of genuine hemoptysis, and if all other causes than pulmonary tuberculosis can be excluded, and there are suspicious symptoms or physical signs, or both, a positive diagnosis of early pulmonary tuberculosis should certainly be given; and even in the absence of suspicious symptoms and signs, since in a very large majority of cases there is a small or deep-seated tuberculous lesion in the lung, though the lesion may heal completely without treatment, there are grave risks, and the only safe course is to put the patient promptly under proper treatment.

Mitral disease is the most common cause of hemoptysis outside of tuberculosis. Rarer causes are diseases of the blood, hemophilia, some acute specific fevers, suppurative processes in the mediastinum, foreign bodies in the air-tubes, bronchiectasis, paroxysms of whooping-cough, injury, pulmonary syphilis, aspergillosis, actinomycosis, hydatid, new growth, and pneumonokoniosis. Lastly, Osler believes hemoptysis may occur in vascular degeneration.

Much Granules. W. Neumann and R. C. Matson<sup>4</sup> report 14 cases in which they have searched for tubercle bacilli and failed to find them by the methods of Ziehl-Nielsen or Weichselbaum, but were able to demonstrate them by the Much method of staining. They conclude that there are forms of tuberculosis that cannot be detected by the ordinary methods of staining, even with the help of antiformin, in which many granules of the character of those described by Much can be demonstrated. These cases pursue a favorable course under

<sup>(4)</sup> Beiträge z. Klin. der Tuberkulose, B. 24, H. 1.

the guise of bronchitis or emphysema, and are chiefly of importance because the bacilli are a source of dissemination of the disease. As a rule the specific tuberculin reactions fail in these cases. The explanation of these cases seems to be that the fatty envelope of the bacilli has been injured by the immunizing forces of the organism so that they are no longer acid-fast.

The danger from this class of patients should be fully appreciated; they are frequently older people supposed to be the subjects merely of the asthma or bronchitis incidental to old age and hence are often intrusted with the care of children whom they infect with tuberculosis

as a result of their intimate association.

[Much and others have shown that there is a form of the tubercle bacillus which is not stainable by Ziehl's carbol-fuchsin method. Much distinguishes a special granular form of the tubercle bacillus, and believes that the tubercle bacilli that are not stainable by Ziehl's method, but are stained by Gram's method, can be diagnosed by these granules. He distinguishes three forms of tubercle bacilli. 1. Bacilli broken up into granules. 2. Very fine rods which are demonstratable only by Gram's method. 3. Acid-fast rods impregnated with a fatty acid substance.—S.1

Antiformin Method of Staining Tubercle Bacilli. The Journal of the American Medical Association<sup>5</sup> describes the technic of the antiformin method of examination for tubercle bacilli as follows: "Antiformin is a strongly alkaline solution of sodium hypochlorite. The collected expectoration of a number of hours is treated with an equal volume of a 20 to 30 per cent. solution of antiformin. On gentle agitation of the mixture the tenacious mucoid material will dissolve and all the bacteria, except those belonging to the acid-fast group, will be destroyed. The material is centrifugalized and the sediment is spread on slides, dried in the air, fixed by heat or by immersion for several minutes in a 2 to 3 per thousand solution of mercuric chlorid, washed off, and stained as usual."

<sup>(5)</sup> June 8, 1912.

According to M. Landolt, this method has, however, a large number of sources of error, which must be avoided if good results are to be obtained. One of the most serious sources of error is insufficient shaking. Before proceeding it is necessary that the solution should be as thin as water. For further investigation a centrifuge is almost indispensable, preferably a water centrifuge. Sedimentation may, however, also be brought about by a pointed glass rod, but is much slower, as the sediment must be repeatedly washed out. With this repeated shaking which is necessary, it is easy to lose some of the sediment.

The thorough washing out of the sediment is of the greatest importance. As soon as the sediment in the point of the small tube of the centrifuge has settled, the supernatant liquid is carefully poured off and replaced by water. In order to stir up the sediment the tube is shaken again. Then it is centrifuged once more and the process repeated, until the water remains perfectly clear after centrifuging. It is then carefully poured off. If this thorough washing of the sediment is omitted, a white layer of salts forms on the slide when the sediment is spread out preparatory for staining, and will cause a sediment by decomposing and precipitating the carbol-fuchsin.

Albumin Reaction. From a consideration of the value of the albumin reaction in sputum in pulmonary tuberculosis M. Fischberg and D. Felberbaum' conclude as follows: The albumin reaction of the sputum, while not infallible, can be considered a valuable addition to our diagnostic aids. A positive albumin reaction in a case accompanied by expectoration is strongly suggestive of tuberculosis. If the patient is found not presenting signs and symptoms of emphysema with cardiac dilation, the presumption in favor of tuberculosis is stronger. In the advanced stages of this disease a negative reaction does not always prove that we are dealing with a cured case, because cases are met with showing tubercle bacilli, yet giving a negative albumin reaction.

<sup>(6)</sup> Correspondenz-Bl. f. Schweiz. Aerzte, Jan. 10, 1912. (7) Med. Record, Oct. 28, 1911.

The test is very simple, any one can perform it as easily as the examination of urine for albumin, and it should, therefore, be applied in all doubtful cases. Very often it will shed some light on a case which may otherwise prove puzzling.

Tuberculin Tests. L. Brown<sup>8</sup> regards the tuberculin test as specific and relatively free from danger. The reaction necessary to a diagnosis by the subcutaneous

test is decidedly unpleasant.

The Value of the Tuberculin Test. A test, to be of real value, should enable us to differentiate not only tuberculosis from other diseases, but also clinical tuberculosis from non-clinical tuberculosis. The latter is an infection with tubercle bacilli, which has not reached a stage in which it can be diagnosticated clinically, while the definition of "clinical tuberculosis" is self-evident. Clinical tuberculosis may be masked, active, quiescent, or arrested,—stages which can be separated only by the symptoms and physical signs which the patient presents, or by the lack of them.

Brown has come to believe that the failure to react to 10 mg. of old tuberculin, given subcutaneously, does not exclude clinical tuberculosis. However, in the presence of indefinite symptoms, it indicates that in all probability treatment is unnecessary. He has allowed these patients to return home at once, and so far no doubtful clinical case, which has failed to react to 10 mg., has

relapsed, after one to six years.

The cutaneous test is of value in early life, though when its reliability ceases is difficult to determine. Brown cannot accept a negative skin reaction as excluding either tuberculous infection or clinical tuberculosis, as he knows of tuberculous patients in good condition who have failed to react to old tuberculin in full strength. This absence of reaction of the skin or conjunctiva may indicate only that no sessile receptors are present in these parts, not that the patient is without tuberculous infection.

The intradermic test should, theoretically, be far more accurate than either the conjunctival or the cutane-

<sup>(8)</sup> Amer. Jour, Med. Sciences, October, 1911.

ous test, however applied, for all the tuberculin given reaches the interior of the skin. It admits further of accurate dosage which, on account of the possible variation in power of absorption of the skin and the difficulty of keeping all the solution over the abrasion or in the conjunctiva until absorbed, is impossible in either the cutaneous or the conjunctival tests. In some instances certainly it is more sensitive than the skin test, reacting where the latter is absent. While a dose of 0.02 of a milligram has never caused a general reaction, Brown has no record of any patient failing to react to this dose given intradermically.

In brief, if we except, for the time being, leprosy, tuberculin is a specific test for the detection of tuberculous infection. The danger from the use of the tuberculin test is slight, but in some unsuitable cases very real and possibly severe. Reaction, even when severe, has no connection with the appearance of tubercle bacilli in the sputum. Increase of physical signs occurs in about one-third of all the cases and in one-half of those with increase of pulmonary symptoms, and is independent of the appearance of tubercle bacilli in the sputum. In practice, exposure to infection, characteristic symptoms, such as hemoptysis, pleurisy with effusion, dry pleurisy on both sides, and localized persistent physical signs at one apex, are diagnostic data of far more importance in clinical tuberculosis than that derived from the tuberculin tests. A positive reaction, when only doubtful symptoms of pulmonary tuberculosis are present, is of uncertain value unless the pulmonary symptoms or signs are definitely increased during the reaction. A negative reaction is of uncertain value, and in the face of positive symptoms carries little weight. In many instances the tuberculin tests add only confusion to the clinical data. The subcutaneous test, depending as it does upon the reaction at the site of the lesion, is still to-day the most reliable of the tuberculin tests; but neither this nor any of the modifications as yet devised differentiate clearly clinical tuberculosis that demands vigorous treatment from nonclinical tuberculosis that requires only a God-fearing life.

From careful investigation G. Schroeder<sup>1</sup> concludes, on the other hand, that tuberculin is of no value for

the diagnosis of active tuberculosis in adults.

Auto-Inoculation Test. H. W. Crowe<sup>2</sup> places a high estimate on the auto-inoculation test as elaborated by Wright and his collaborators. In 1906 Wright described spontaneous fluctuations of the tuberculo-opsonic index in febrile cases of tuberculosis and affirmed the possibility of determining whether any given fever were associated with the tubercle bacillus, by observing a series of indices, and marking the presence or absence of these fluctuations. The explanation Wright gave of this phenomenon seems quite convincing. He postulated a periodic change in the amount of toxic products entering the blood from a diseased focus. By day increased movement and bodily activity would, even when a patient was confined to bed, result in an increase of the blood-flow through the whole organism, and toxic material would be washed out the more readily from the focus of disease into the general circulation. To this the system must respond by an increased production of immune substances. Hence come the fluctuations in the tuberculo-opsonic index, which, in point of fact, is an indicator of the amount of such response. To this periodic flow of toxic material Wright applied the term "spontaneous auto-inoculation."

Freeman found that massage applied to a diseased joint was followed by an increased amount of toxin in the circulation, demonstrable again by a very definite fluctuation in the opsonic index, provided only that the index was determined in respect of the causal organism. This he termed an artificial or induced autoinoculation, and he was able to utilize his discovery to elucidate the nature of joint troubles of doubtful origin. The example he first quoted was that of a knee-joint said to be tuberculous; after massage the tuberculo-opsonic index did not fluctuate, whilst the index determined in



<sup>(1)</sup> Beiträge z. Klin. der Tuberkulose, B. 23, H. 1.
(2) Brit. Med. Jour., June 1, 1912.

respect of the gonococcus gave a marked and typical fluctuation. The inference drawn by Freeman was that the disease must be gonorrheal and not tuberculous.

Error may be due to an insufficient excitation of the auto-inoculation. Crowe uses an apparatus by means of which forced respiration, continued for a period of some minutes, can be used to produce auto-inoculation in a tuberculous lung. The presence or absence of such auto-inoculation is then determined by measuring the opsonic index before and at varying periods after the exercise. Crowe gives the following conditions which the ideal diagnostic test must fulfil. First, it must be harmless; secondly, it must confine itself to pointing out the presence of active or smouldering tubercle—it must not be too penetrative; thirdly, the answer given by it must be unmistakable; fourthly, it must be universally applicable; fifthly, it must be simple; sixthly, it should be practicable after treatment to determine the time when cure is complete; and, lastly, the ideal test must be infallible. Of these seven canons, then, it will hardly be denied that the first and the last are the most important.

In 61 tests, 23 were crucial cases in which the diagnosis of tuberculosis was to be definitely made or denied. In each case a definite answer was given and in no case was there evidence that the verdict was wrong. Crowe concludes that the test is harmless, not too penetrative, and in his opinion, under proper conditions, the answer is unmistakable. It can hardly be said that it is universally applicable or that it is simple so far as the laboratory technic is concerned, but in regard to the observations on the patient, it is quite simple. He finds that it can be used to determine the efficiency of treatment and that it answers the criterion of infallibility.

## PROGNOSIS.

Cuti-Reaction. L. Bernard and Baron<sup>3</sup> give the following conclusions from their investigations of the prognostic value of the cutaneous reaction to tuberculin.

<sup>(3)</sup> Presse Méd., June 12, 1912.

From the results obtained by it the conclusion may be drawn that the reaction of von Pirquet constitutes in the adult an important element in the prognosis of tuberculosis, if the phenomena are properly interpreted.

Strong cutaneous reactions are always met in tuberculous patients with slight affections and with an energetic resistance, and they present a favorable course of the disease. Patients who show moderate reactions, especially those in whom the cutaneous reaction made in a series shows the persistence of the reaction, are generally patients who bear lesions, often advanced, quite well. As a rule their death is due to an accident like hemoptysis or an intercurrent infection. On the other hand, in every case in which the cutaneous reaction has been weak, or has become attenuated after having been positive, the patient has succumbed to his disease.

As to negative reactions, they have never yet caused a mistake. Tuberculous patients who no longer react to the cutaneous tuberculin test are destined to a rapid

decline.

The cutaneous reaction has prognostically little interest in cachectic tuberculous patients, but in a number of cases it is of great service where the clinical symptoms alone often do not permit the formation of a

prognosis.

In incipient tuberculosis especially, it is very often impossible by clinical symptoms alone to say what will be the evolution of the disease. If the reaction is marked or even of moderate intensity, we have to deal with a form of the disease the course of which one may hope to moderate. If the reaction is weak, or if at first it becomes weak, the prognosis is serious, and the chances of cure are less favorable.

In advanced tuberculosis the cutaneous reaction also renders great service. It indicates the defensive power of the patient. If it is positive it shows the arrest, or at least a slow and relatively favorable course of the disease.

In acute tuberculosis, and especially in the acute attacks in the course of chronic pulmonary tuberculosis, the tuberculin test is valuable as showing in what direction the disease is developing. A negative cutaneous reaction indicates a very serious prognosis. A positive reaction shows that the organism is defending itself energetically and that one may hope for a successful result of the struggle.

While there is evidence that the cutaneous tuberculin reactions afford a very important element in prognosis, often superior to clinical evidence, it is not proper to expect more of them than they can accomplish. They do not permit one to foresee intercurrent accidents, sudden complications which often modify the natural course of tuberculosis, nor do they make it possible to determine the distant future of the tuberculous patient, but they afford reliable indications of the peculiar characters and actual state of the process as well as of the defensive power of the patient. In a word, the cutaneous reaction does not draw a horoscope, but it simply offers an important contribution to the estimation of the prognosis. Cutaneous prognosis of itself cannot indicate the future. Along with other and perhaps better signs it gives information with regard to the probable course.

Arneth Blood-Picture. In the opinion of P. H. Ringer<sup>4</sup> the Arneth blood-picture has a certain definite value in forming a prognosis in pulmonary tuberculosis. It is a corroboratory factor to the general clinical picture, and should never be given much weight in contradiction to the general symptom-complex presented by the patient. In a small number of cases it will presage an unfortunate outcome or else will cause us to pause before giving a bad prognosis. In a small number of cases it will remain opposed to all the general indications found in the patient. In the vast majority of cases it will faithfully represent the patient's resisting powers but will not disclose any new features.

**Prognosis of Laryngeal Tuberculosis.** L. Brüll<sup>5</sup> draws the following conclusions as to the prognosis of laryngeal tuberculosis:

<sup>(4)</sup> Am. Jour. Med. Sciences, October, 1912. (5) Beiträge z. Klin. der Tuberkulose, B. 23, H. 1.

1. Laryngeal tuberculosis in all its forms may heal

completely.

2. The chances of a permanent cure are somewhat better for men than women. There is scarcely any difference with reference to age. On the other hand, the prognosis is less favorable for those with a hereditary predisposition than for those who have no such taint.

3. The prognosis of laryngeal tuberculosis depends to a large degree on the extent and prognosis of the

accompanying disease of the lungs.

4. The success of treatment of the larynx depends to a still greater degree on the temperature. The prognosis in patients free from fever is three to four times more favorable than in those who have fever.

5. Closed tuberculosis of the lungs presents a more favorable prognosis so far as the larynx is concerned

than open cases.

6. An appropriate therapy based on distinct indications may greatly improve the chances of healing and thus assure a more favorable prognosis.

## TREATMENT.

General Measures. L. Brown<sup>6</sup> discusses the value of fresh air and of such half-measures as the windowtent and thorough ventilation of the room. While these are not to be compared in value with sleeping in the open air they are better than nothing. A question that must be decided frequently is whether the roof or the back yard is the best place in which to take the freshair treatment. Brown does not hesitate to say that the roof should be used in every instance, where possible, for several important reasons. The number of bacteria. the quantity of dust and the temperature of the air decrease directly with the elevation above the street, while the movement of the air increases. This leads to fewer secondary infections, and to less irritation of the respiratory tract, and subjects the body to a far better hygienic environment. In summer, however, the roof may be too warm.

<sup>(6)</sup> Jour. Amer. Med. Assoc., June 1, 1912.



These newer ideas about fresh air throw grave doubts on the efficacy of "air carriers" and emphasize the necessity of life in the open, "living" air. Brown's experience after observing patients for ten years does not lead to the belief that sleeping out-of-doors materially hastens recovery, provided eight or ten hours a day are spent in the open air and the night passed in a well-ventilated room. When, on the other hand, the patient returns to his indoor work, then sleeping out is very necessary. Ozone is said never to occur in rooms, however well-ventilated, but it is of no value to man except as an indicator of the purity of the atmosphere.

In regard to diet, give the tuberculous patient what he can use, but reduce his diet to the lowest point at which he will gain the required amount of weight. The tuberculous patient with an early lesion is often about ten to fifteen pounds below what he should weigh for his height and age. We should aim to bring this patient up and slightly beyond this weight, which is often ten pounds above what he has usually weighed. We should . not try to do this, however, by too rapid gains, too forced feeding, which but too often defeats its very purpose. We should be satisfied with a gain of a pound a week and a digestive system in fine order. Now, when the required weight is attained, let the diet be reduced to the lowest point which will give satisfaction at the table and sustain the weight. This reduces to a minimum the quantity of waste which the excretory organs must take care of, makes out of many patients very different individuals, and reduces greatly gastrointestinal disturbances.

Brown's first advice is gradually to quit taking milk and to eat only three meals a day. These meals should gradually be made to approximate what he must eat in the future. Fats are more easily taken in sufficient quantities than proteins or carbohydrates, but popular knowledge so emphasizes the importance of proteins that it is more necessary to push the carbohydrates.

His further advice is: "Eat as little as you can in order to gain, but you must gain this number of pounds. When you reach that weight, eat less still and

just enough to maintain your weight, avoiding milk. You will have little upsets, little flare-ups of the disease, during which you will lose weight. Then the milk, which you have cut out of your dietary when you have gained enough, should be replaced and will enable you to regain quickly the pounds you have lost. It is not the amount you eat but what you assimilate that is important."

În regard to auto-inoculation, it is a great temptation to all sanatorium authorities to push it. The big, husky fellows, the robust, buxom lassies that sit about on porches or stroll around taking their exercise, possess much potential energy that it is a great pity to lose. This alone is a strong argument in its favor, but, to make it a success, there are certain requirements that are difficult to obtain. Excessive auto-inoculation must be met by absolute rest, and few institutions have a nursing staff large enough to give the patients proper treatment. A certain number of patients fail to improve under this line of treatment, and some feel that they have been injured. This, however, can be disregarded when due care has been exercised.

A comparison between the figures published by Paterson at Frimley and those at the Adirondack Cottage Sanitarium, where a certain number received tuberculin treatment, seems to indicate that the permanent results may be better among the patients discharged from the latter institution. Brown believes that the treatment by auto-inoculation in pulmonary tuberculosis is fraught with grave peril, and he hesitates to use it.

Brown believes we have overlooked the value of rest of the lungs in pulmonary tuberculosis—secured only when the patient is in bed. He has known two patients, one with a broken leg, the other with a tuberculous ankle, make pulmonary recoveries only when absolute rest in bed had become necessary on account of the complication. A patient with an early lesion and elevation of temperature should remain in bed for some time, and rest in bed will help the cough and expectoration more in many cases than any form of treatment. Digestive disturbances are often more readily combated when to

the treatment is added rest in bed. One must of course use discretion, for not all patients can be so treated. At first liberties should be permitted only on every other day, and the following day should be spent in bed.

Rest in bed is essential in all early cases for some time, as well as for any patient who is not doing well. Rest harms few patients even when carried on longer than necessary. Exercise is often fraught with danger and must be prescribed as carefully as arsenic or

strychnine, for an overdose is not less deadly.

Cheerfulness. P. H. Ringer, in closing an account of the treatment of tuberculosis, says: The inculcation of cheerfulness is one of the greatest aids. The dwelling on self—the morbid—symptom-talking, the wave of discouragement when the temperature is found to be half a degree up—all these are to be shunned. The patient should understand the general principles of his disease, but nothing is worse than to allow an individual with tuberculosis to get a book on the subject and "read up." No man can look upon his own case philosophically and dispassionately, and any knowledge that he is to gain thereon should come directly from his medical adviser. The fight for health is a three-fold onephysical, mental, and moral. To the victor belongs the spoil, and the man that wages a successful conflict comes forth therefrom a better individual in all ways than he was at the start; strengthened physically, upbuilt mentally, trained and stimulated morally. His months of waiting, of sacrifice and self-denial, his determination to get well, his extra efforts in dark hours, his smile ever turned outward and gradually turning inward in the face of vicissitudes; all these produce a larger, stronger, nobler individual than would have obtained had not misfortune fallen across his path and given him a great opportunity to prove to himself and to his fellows the potential might that is and ever will be the bulwark of him that fights a good fight.

Lime Starvation. J. F. Russell<sup>s</sup> describes as follows a class of patients treated by him on the basis that the

<sup>(7)</sup> Virginia Med. Semimonthly, Sept. 13, 1912.(8) Med. Record, July 1, 1911.



dietetic cause of the disease is lime starvation. The patients are self-supporting working people and are treated without interruption to their work, the dispensary hours being arranged with this end especially in view. Patients with uncomplicated pulmonary tuberculosis, in any stage of the disease, are admitted whose evening temperature is below 101°F., and who are clearly not too weak to make the journey from their homes twice daily; who can provide proper food, clothing, and shelter, and who live within reasonable distance of the dispensary. When other symptoms are favorable patients whose evening temperature is 101°F. or more, are accepted provisionally because it has occasionally been found that, after one or two weeks of treatment, the temperature falls and remains in the neighborhood of 100°F. An evening temperature of 100°F, and 100.5°F. is not a bar to treatment. No patient with laryngeal tuberculosis in the stage of ulceration is admitted for treatment. No patient is admitted whose sputum does not show the presence of tubercle bacilli. Patients are considered apparently cured when physical signs of disease are no longer present and tubercle bacilli have disappeared from the sputum. Tubercle bacilli are considered to have disappeared when six consecutive examinations, two weeks apart, fail to show their presence.

The most important question next arises, "Do these people, apparently cured under these circumstances and still continuing to work and live in the city, hold their improvement? Russell finds that these patients maintain their improved condition and he thinks the percentage of cures (55.8 per cent.) compares favorably with the work done at the best sanatoria.

Heliotherapy. Two kinds of sun baths are distinguished by Chatin and Gaulier<sup>9</sup>: warm, above the temperature of the body, and cold, below that temperature. Experiments were made with baths of the first class, the temperature being 50°C. Of 6 children 3 were favorably influenced, 3 unfavorably. In one case the bath was followed by slightly bloody sputum. The temperature of the body rose at the highest 0.6°C., but

<sup>(9)</sup> Jour. de Physiotherap, October, 1912.

as a rule much less. The cases belonged to a variety of stages and forms of pulmonary tuberculosis. The most distinctly unfavorable were severe cases with cavities, an abundant purulent sputum, and bad general condition. The authors feel justified in recommending this treatment in incipient cases. The seances lasted from 15 minutes in the beginning to four hours after a protective pigment had formed in the skin. It is necessary to place the patient in a comfortable position and protect his head.

The Work Cure. O. Bruce¹ describes the method of treating pulmonary tuberculosis by graduated labor as practiced in the Brompton Hospital Sanatorium. The clinical symptoms and the temperature-chart were found to be a sufficient guide as to the amount of work to be prescribed. The extent of the disease is a valuable indication only in cases of long standing where extensive

involvement shows good resisting powers.

A temperature of over 99°F. in man and 99.6°F. in women was taken as a contra-indication. The patient is first confined to bed until his temperature has been continuously below normal for ten days. The next step is to allow him to get up for a certain time every day and to note the effect, if any, on his temperature and symptoms. Bruce starts patients with one hour a day, sitting up in a chair but without dressing. Needless to say they should be wrapped in sufficient blankets to keep them warm. The process of dressing is a trying one and requires considerable exertion. It is not until patients have been getting up for one hour a day for three or four days without any rise of temperature to 99°F, that they are allowed to dress. They then sit up for one hour a day dressed, and this is gradually increased at intervals of about five days, until the patient is up the whole day, but all the time is doing no more than sitting in a chair. At the end of that time he may be allowed to walk as far as the dining-hall for meals, and after having been at this stage for about five days, gentle walking exercise is prescribed. The distance first set to be walked should be half a mile a

<sup>(1)</sup> Canad, Med. Assoc. Jour., March, 1912.

day, and it should be walked slowly, at the rate of about two and a half miles an hour, and if possible over gently undulating ground. A close watch being kept on the temperature chart and feelings of the patient, the distance walked is gradually increased. One mile, two miles, four miles, six miles, and, finally, ten miles a day are prescribed in turn, and about a week is spent at each distance.

At the end of this time the patient is fit for work, but this must be light and should be divided into grades as follows:

Grade I. Otherwise known as the "basket grade." Patients collect, into a small basket, mould for spreading on lawns, weeds, or dead flowers, and carry them a certain distance. Baskets hold a weight of ten pounds. Time to be spent on this grade, one week.

Grade II. Similar to Grade I, but larger baskets should be used, holding a weight of eighteen pounds. The material should be carried a distance of fifty yards.

Time to be spent on this grade, one week.

Grade III. Patients to sweep paths and cut grass, cut grass edges, chop firewood, hoe, paint with a large brush, and clean windows. Time to be spent on this grade, one week.

Grade IV. Patients to use a small shovel or dig with a small fork. A hand-cart containing soil or stones may be pulled by patients in this grade, five patients working together in pulling such a cart. Mowing grass may be substituted, three patients being allotted to a sixteeninch mower. Time to be spent in this grade, two weeks.

Grade V. Patients to use a large shovel or a small pickaxe, or dig with a large fork. Pulling down trees, trenching ground three feet deep, hauling stones in a cart, using a wheelbarrow, and doing general heavy navvy work, or sawing and planing wood may be substituted. Time to be spent in this grade, three weeks.

Grade VI. Three weeks before their discharge, the patients are promoted to this, the final, grade. The work is similar to that in Grade V, but they spend six hours a day at it, instead of four. If possible the patients on this grade are set to work at their own trade or

profession, so as to bring into play the special muscles used for their particular work. In the case of women patients, the final work prescribed is scrubbing floors and general housework, such as they are likely to have to perform at home.

This is a rough outline of the routine of work as carried out at the *Brompton Hospital Sanatorium*. Different conditions will require modifications of this program, and especially is this the case in Canada in the winter months. Some difficulty will be experienced then in finding suitable work for the patients to perform, owing to the small amount of work possible on the frozen or snow-covered land.

The work should always have some definite object in view, for work that is purposeless will without doubt become wearisome and monotonous, and patients will not take kindly to it.

After each period of exercise an hour's rest should be rigidly enforced. The patients should be given to understand that the work prescribed is not done for the benefit of the institution, but that it is an important element in their treatment and actually helps to heal the diseased lungs.

The theory of auto-inoculation in pulmonary tuberculosis and its application by graduated labor is explained by immunity and the action of the bacteria on bloodfluids. The nearness of the lesions of phthisis to the blood-stream is shown by the great vascularity of lungs, the frequent destruction of the blood-vessels and the frequency of hemoptysis. Respiration directly affects the circulation. Any stimulus to the respiratory tract also increases the speed at which the blood is carried through the affected focus, and raises the blood-pressure.

The micro-organisms not only throw out poisons into the blood-stream but also stimulate the manufacture of antibodies unless the amount of toxin is too great, when few or no antibodies are formed and excessive auto-inoculation occurs.

Wright found that after inoculation with tuberculin there followed first a lowering of the opsonic index, which he called the negative phase, and later a rise in the opsonic index, which he called the positive phase, and a final return to normal. In applying these facts to treatment with graduated labor we must first check the excessive production of toxins, which can usually be accomplished merely by rest. This must be as nearly absolute as possible, the patient not being allowed to move for anything not absolutely necessary, not even to feed himself or go to the lavatory, since the mere exertion of sitting up in bed hurries the respirations and consequently the circulating blood.

After the temperature has returned to the normal for a week or ten days, showing that the production of antibodies is sufficient to cope with the toxins produced, the attempt is made to make the patient manufacture antibodies in excess of toxins by a slight amount of auto-inoculation. This can be brought about by a very small increase of exertion. Such increase, occasioned by promotion from the various grades of work, gives the required auto-inoculation, raises the opsonic index again, which has probably fallen toward the end of the previous grade, and brings about immunity to large doses of toxin until the hardest work may be performed without affecting the lesion or opsonic index.

In the blood examinations made by Bruce the opsonic index was invariably raised much above the normal as the result of the graduated labor. A certain class of patients having few physical signs and in fairly good condition invariably showed a rise of temperature from normal when allowed to get up, and as their indices were found to be very low, increase of exertion or a bigger auto-inoculation was attempted with success and increase of the opsonic index. In other cases where the temperature did not return to normal after months in bed increased exertion reduced the temperature to normal. The periods of rest as well as of labor should be carefully graduated so as to prevent the patient from overdoing before he is fit.

The mental and moral effect of the treatment is also important, as the work gives the patient something to occupy his mind and prevents his brooding over the disease. For this reason patients still in bed, unless on

"absolute rest," should be given some light occupation, such as sewing, knitting, etc. Each promotion in the grade of work encourages the patient, making him feel nearer recovery and by the benefit to his mental state also improves the physical condition.

A. Robin<sup>2</sup> also describes the methods employed by

Patterson at the Brompton Hospital Sanatorium.

Tuberculin. G. Schroeder<sup>3</sup> concludes as follows: 1. In adults tuberculin is of no value for the diagnosis of active tuberculosis. 2. There is no evidence that tuberculin tolerance assures a cure. 3. Tuberculinimmune patients seem inclined to severe relapses. Toxin susceptibility is a symptom of immunity and cannot be artificially removed. 5. Even in severe cases recovery may be favored by very small and not too frequent doses of tuberculin. The most important factor in the cure is the physico-dietetic method of treating tuberculosis. Tuberculin acts only as an adjuvant. Very small doses of the specific antigen appear to excite the formation of connective tissue in the diseased focus. 7. The use of tuberculin preparations in general practice is still earnestly to be advised against.

There seem to be indications in the literature that tuberculin treatment is not advancing in medical favor. The opinions which will be presented are most of them favorable, but the remedy is far from being a panacea. Experimental work which is reported shows that it is not possible in animals treated with doses corresponding to those used in human therapeutics to secure definite proof of curative effects. Observers seem to agree that tuberculin must be used with caution: that it does not immunize against the disease, but merely secures tolerance of the disease toxins. Statistical tables are frequently misleading. A comparison of equal numbers of cases selected so as to present as nearly as possible identical phases of the disease have shown little difference in the results. A psychic element in the tuberculin treatment must not be lost sight of. The effect of popular opinion and expectation of cure must be allowed for

 <sup>(2)</sup> Therap. Gaz., Dec. 15, 1911.
 (3) Beiträge z. Klin. der Tuberkulose, B. 23, H. 1.

in estimating the value of all forms of treatment for tuberculosis. This is particularly applicable to the Friedmann treatment, which has been heralded with such acclaim in the newspapers.—S.]

Tuberculin Is Experimentally Ineffective. According to the experimental work of H. Haupt\* on infected rabbits and guinea-pigs, tuberculin applied as in the treatment of human tuberculosis produces no effect either favorable or unfavorable on the course of the disease. The treated animals neither lived longer nor did they show any less extensive progress of tuberculosis than the control animals. The tuberculin injections caused no abscesses nor was the body weight seriously influenced in either the treated or the untreated animals. Reparative changes which might be interpreted as evidence of healing, such as fibrous or calcareous degeneration, were found in rare cases both among the treated and among the control animals.

Caution in the Use of Tuberculin. In summing up his remarks on the use of tuberculin, R. A. Peers says that it is of undoubted value. The principal proof is that those who use it most are satisfied of its value. On the other hand, tuberculin does not cure tuberculosis. It probably does not make so much difference what particular make of tuberculin is used providing one gets a product manufactured by a reputable firm. The principal thing is how it is used. In other words, it is not the preparation but the manner of using. Tuberculin should not be used by the inexperienced, who have only a text-book knowledge of the drug, any more than a capital operation should be performed by anyone who has merely a text-book knowledge of surgery. culin should not be used in febrile cases, in which the temperature exceeds 100°F., except in extremely minute doses. The ordinary stock dilutions 1, 2, 3, 4, 5, should be supplemented by much weaker dilutions. No. 1, which contains .01 mg. per c.c., is too potent for commencement: Tuberculin should not be measured as so many minims of a given dilution; it should be given

<sup>(4)</sup> Beiträge z. Klin. der Tuberkulose, B. 23, H. 4.(5) Cal. State Jour. Med., March, 1912.

with a special syringe graduated to 1-100 of a c.c., and the dose calculated in fractions of a mg.

Patients should not be given tuberculin who do not keep an accurate daily record of their symptoms and where they cannot be given careful personal supervision, preferably daily. Patients should not be given tuberculin where they have to come miles by train to receive the dosage, or where they are engaged in laborious undertakings. Much of the benefit from tuberculin administration lies in the fact that such patients are under daily supervision over a correspondingly extended period. It is not fair to lay at the door of tuberculin all the accidents that occur while the patient is under treatment, or to ascribe all the benefits during its use to other factors. Nor is it fair to ascribe all the benefit to tuberculin and to blame the reactions to other causes.

It is best in giving tuberculin to avoid even moderate reactions. These will undoubtedly sometimes occur even under most careful treatment. If disregarded, disaster will follow. On the other hand, patients will sometimes make more rapid recovery after a prenounced reaction than at any previous time. In giving tuberculin, if in doubt as to the advisability of increasing the dose, do not increase.

Practical Application of Tuberculin. C. Riviere<sup>6</sup> gives the following statement of the action and practical application of tuberculin: If we consider a case of localized tuberculosis we find that we know the following facts: First, the opsonic content of the blood is below normal; secondly, the opsonic content, and therewith probably the presence of other antibodies, is especially low in the focus of disease; thirdly, the striking point about this focus is its very deficient blood-supply. Localized tuberculous areas are but poorly vascularized, and on this account both disease and repair, when left to themselves are extremely slow. The tubercle bacillus is walled in from the protective substances in the blood; bacillary substances filter through but slowly to stimulate the production of antibodies; food for nutrition of the cells in the neighborhood is kept constantly scarce.

<sup>(6)</sup> Brit. Med. Jour., Apr. 6, 1912.

How does an efficient dose of tuberculin influence the course of localized tuberculosis? First, the immediate effect of a dose of tuberculin possesses an element, the focal reaction, which is of infinite value in the treatment of localized disease. The main difficulty is at once overcome; blood, carrying antibodies and nutriment, is brought to the area of disease. This becomes obviously more vascular, and the plasma passing through it is increased.

Secondly, in the period following the reaction there is a general increase of antibodies in the blood, shown in the "positive phase" of opsonic power, so that at the next injection more highly protective blood will flood the focus of disease. The result of the focal hyperemia and the increase of antibodies shows itself in a marked healing tendency observable in visible tuberculous areas in the second week after an injection.

We may now consider the administration of tuberculin in cases of localized tuberculosis from the point of view of practice. It is obvious that the following aims must be put before us:

1. To irrigate the diseased area by the production of

a mild but prolonged focal reaction.

2. To keep the opsonic power of the blood at a high

level for as long a period as possible.

In connection with pulmonary tuberculosis Riviere discusses the occurrence of reactions which in general he endeavors to avoid, and in this connection he discusses the value of tolerance to large doses which some attempt to secure by the use of doses which produce repeated reactions.

Is there sufficient evidence of its value to justify us in making it an aim? If we turn to animal experiment for a moment we find that tuberculous disease protects against further infection with the tubercle bacillus. Experiments have been done on cattle, guinea-pigs, and, more recently, apes, which show that if virulent bacilli are injected into a healthy animal, no symptoms follow immediately, but after an interval symptoms of tuberculosis appear, and the animal dies. If similar injections are given to a tuberculous animal, on the other

hand, a violent "reaction" immediately follows, but the animal shows no fresh tuberculous disease. Here we find that sensitiveness to tubercle products (not tolerance) is associated with protection against fresh infection. We might, therefore, fear that by producing tolerance we were removing a valuable safeguard against

the further spread of disease.

We are, it is true, removing from the patient, for a time, the power of auto-inoculating himself, and this might be a danger where tuberculin was withheld. It is, however, highly unlikely that tolerance removes in any way the power of the tissues of the tuberculous to deal with the tubercle bacillus. More probably the injected tuberculin is "activated" as before, and tolerance only protects the tissues, the nervous system and focus of disease, from the toxic effect which follows. This may, be by the production of some such body as the "antituberculin" of Wassermann, which is shown to increase under tuberculin administration on the intensive system. If this is the case the condition underlying tuberculous sensitiveness is not removed, but its effects are mitigated.

On the other hand, there is no reason to suppose that tolerance adds anything to immunity against further disease, and for this reason the common use of the word "immunity" where tolerance is meant is greatly to be deprecated. All that tolerance does—and this is no small advantage—is to free the patient from those symptoms of autotuberculin poisoning which were undermining his health, and from dangerous focal reactions, which were spreading the disease. At the same time it enables us, as we have seen, to treat autotoxic disease with doses of tuberculin so large as not to be unduly interfered with by auto-inoculation. The value of tolerance depends, then, on the need of it in any particular case, and not in all cases of phthisis is tolerance to large doses required or even advisable. need, on the other hand, of obtaining repeated response to tuberculin, in the form of mild focal reaction and antibody stimulation, is common to all varieties of tuber-This appears to be Nature's method of cure, culosis.

and if it is followed on rational lines, and the needs of each individual case carefully studied, it will be found that we have in tuberculin, and the control of autotuberculin, all or nearly all that we need for the cure of tuberculosis.

Clinical Experience With Tuberculin. J. Ritter considers the value of tuberculin in the diagnosis and treat-

ment of pulmonary tuberculosis:

1. In giving tuberculin for therapeutic effect we must always remain short of a reaction. We occasionally observe during the administration of tuberculin to a tuberculous individual (in minute doses for curative purposes and without the least disturbance) that if too large a dose inadvertently be given, the most alarming symptoms may manifest themselves. This may in part be due to endotoxin poisoning. These larger doses of tuberculin may produce an active bacteriolysis, when the eliminated poison from the bacillary body disintegration and subsequent absorption by the tissues of the body brings about an intoxication and an accompanying aggravation of the symptoms.

2. Clinically we cannot prove to what extent the tuberculous process in the lungs is favorably or otherwise influenced by the use of tuberculin, but we do observe that the long use of this remedy will produce in the tuberculous individual a condition which favors the arrest of the disease. Undoubted proof of the curative properties of tuberculin has been furnished on tuberculous patients treated at the various sanitaria in this country and abroad; for instance, old chronic pulmonary cases which have for years remained unimproved, simply holding their own under ordinary medication and diet, are often wonderfully influenced by a mild tuberculin

impression.

3. All the various tuberculins and sera which are now marketed and which are used for either diagnostic or therapeutic purposes depend for their action on the tuberculin hypersusceptibility of the infected individual; a never-infected person, within certain limits, will not react, no matter how large a dose is administered.

<sup>(7)</sup> III. Med. Jour., December, 1911.

Some tuberculous patients are so sensitized to tuberculin that the most minute dose will bring about a very distinct reaction, and on the other hand again, other individuals with a like progressive pulmonary lesion

are tolerant to comparatively large doses.

4. We all recognize that there is a distinct psychologic element in the use of tuberculin. From nature of a hopeful and buoyant spirit to the last, any innovation will at once appeal to the tuberculous. Were it not for this characteristic of the disease charlatans and quacks would not thrive. The tuberculous who have been under tuberculin therapy for some time, if from any cause the treatment should be temporarily interrupted, will on returning ask that the tuberculin medication be resumed, claiming to have been in much better health during its administration.

The following is a brief summary of the conclusions of B. Möller<sup>8</sup> as to the employment of tuberculin: The most effective treatment of human tuberculosis consists in a combination of sanatorium treatment with tuberculin. In selected cases in the early stage the treatment may be carried out in ambulant practice. The doses should be gradually increased so as to avoid reaction. The method of use is more important than the preparation employed. The treatment should be carefully adapted to the individual case. Hypodermic injection is the preferable method of administration. To secure recovery the treatment must be prolonged and frequently repeated. The tuberculin treatment should not remain entirely in the hands of specialists, but should be employed by general practitioners.

be employed by general practitioners.

R. T. Pettit's has tabulated the results from the tuberculin-treated patients at the Ottawa Tent Colony, comparing them with the results in cases which received no tuberculin. His tables show little difference between the two classes in the incipient stage, but in those moderately advanced the successes amounted to 46.04 per cent. in those treated and to 27.5 per cent. in those untreated,—a difference of 18.54 per cent. in

<sup>(8)</sup> Berlin, klin. Wochenschr., Oct. 14, 1912.
(9) Jour. Ind. Med. Assoc., Oct. 15, 1911,

favor of the tuberculin treatment. Considering the number of deaths the contrast is also very apparent. Of incipient cases 11.5 per cent. died of those who were treated with tuberculin, while of those who did not receive this treatment 25.64 per cent. died,—an increase of 14.14 per cent. For the moderately advanced the figures were 38.2 per cent. of those treated and 62.9 per cent. of those who did not receive tuberculin treatment,—a difference of 24.7 per cent.

[Such figures, while they show an advantage in the specific treatment, must be taken with a certain amount of reservation, as there are many circumstances which might modify the results. The number of untreated cases was 234, a considerably larger number than that of the treated cases, 146. Again it is probable that a considerable number of moderately advanced cases did not receive tuberculin from a feeling that they were not suited to this form of treatment. An unconscious selection of cases favorable to the tuberculin treatment would take place.—S.]

Method of Administration. J. Guy¹ regards the favorite method of giving tuberculin as that of rapidly increasing the dosage until a certain maximum dose, relative or absolute, has been reached. He injects it hypodermically in the interscapular region, beginning with very minute doses of the bacillary emulsion. He compares results in 56 cases treated with tuberculin and 50 without. The figures indicate a slight advantage in

favor of the tuberculin. He concludes:

1. Tuberculin can be administered with comparative safety if the dosage is carefully regulated and the temperature watched.

2. There is nothing from a clinical standpoint which would enable one to say that one variety is better than

motner.

3. In using bacillary emulsions unexpected reactions at times occur.

4. Some cases of phthisis will not get on with tuberculin, and in a certain number this fact can be discovered only by a trial of the remedy.

<sup>(1)</sup> Glasgow Med. Jour., March, 1912.

Albumose-Free Tuberculin. O. Orszag<sup>2</sup> and I. Spitzstein find that Koch's albumose-free tuberculin produces as good results as the old tuberculin, and it has the advantage that it provokes a febrile reaction less often and that unpleasant general symptoms are not produced.

Tuberculinum Purum. C. Rayevsky<sup>8</sup> reports favorable results from the use of tuberculinum purum in 12 patients who took the full course. In 2 patients rather severe reactions were observed which the author attributes to the fact that the Gabrilowitch scheme of doses provides for too abrupt transitions to higher doses. A determination of the differential leukocyte count in the cases observed showed a steady increase in lymphocytes.

Antituberculosis Lymph. G. B. Sweeny has prepared, as the result of investigation of the method of acquired immunity against tuberculosis, a solution of immunizing substances which he calls antituberculosis lymph. Following the administration of this antituberculous lymph compound the following results are observed:

1. Rise of the opsonic index. 2. Approximation of the temperature to normal. 3. Control of night-sweats. 4. Relief of cough and lessening of expectoration. 5. Elimination of pleuritic pain. 6. Regulation and improvement of digestion. 7. A gradual and continuous decrease in the number and vigor of the tubercle bacilli. 8. Chemiotactic activity on the part of the leukocytes; they attack, ingest and destroy the tubercle bacilli with avidity. 9. A sense of returning strength and vigor, with increase in weight.

Bacilli in Collodion Sacs. Heymans<sup>5</sup> has investigated the effect of introducing tubercle bacilli enclosed in reed or collodion sacs, and reaches the following conclusions:

1. Tubercle bacilli grow through the membrane of

Beiträge z. Klin. der Tuberkulose, B. 23, H. 4. N. Y. Med. Jour., Nov. 11, 1911. N. Y. Med. Jour., Nov. 4, 1911. Deutsche med. Wochenschr., June 6, 1912.

the reed sac in the living body, although they cannot do this in vitro.

2. Reed sacs which have been coated with collodion containing glycerin in various proportions possess all degrees of permeability up to semipermeability.

3. Such dialysis sacs which contain up to 1 gm. of killed tubercle bacilli are well borne both by healthy

and by tuberculous animals.

4. Animals which have been inoculated in this way show a preventive and curative immunity against tuberculosis.

5. Tuberculous patients bear such dialysis sacs with

1 cgm. of tubercle bacilli without reaction.

6. In general a tuberculosis preventive inoculation by means of dead bacilli inclosed in dialysis sacs is more worthy of trial than all the previous inoculations with tuberculin or dead or living tubercle bacilli. It must first be determined by extended trials how it succeeds

in practice.

Immunity by Attenuated Living Bacilli. In 1904 Friedmann published an account of his efforts to immunize animals against tuberculosis by inoculation with tubercle bacilli from cold-blooded animals, supposedly avirulent for other species. His "turtle bacilli" preparations were also applied in the clinic, but clinicians soon abandoned this treatment on account of the abscesses that developed at the point of injection. An account of his work in this line was summarized in the Journal of the American Medical Association for 1904.

Recently F. Friedmann<sup>6</sup> announced that he had succeeded in cultivating a race of tubercle bacilli which were naturally free from nearly all toxic action, and had only a minimal pathogenic power and a minimal toxicity. By his selective cultivation this strain of living bacilli have lost the last trace of pathogenic activity and pathogenic power, but have retained the curative power. After he had demonstrated in numerous animal experiments the activity of the preparation derived from this "benevolent" strain of tubercle bacilli, he proved the harmlessness of the preparation for human beings by

<sup>(6)</sup> Berlin. klin. Wochenschr., Nov. 18, 1912.



repeatedly injecting himself, and during the last two years he has treated with this remedy in hospitals and policlinics tuberculous patients of every kind, under the constant critical observation of many physicians.

So far 1,182 patients have been treated, including over 250 with pulmonary tuberculosis, and others with tuberculosis of the glands and skin and "scrofula." According to Friedmann's statements, the result was that when the preparation was completely absorbed (if the body was at first incapable of absorbing it, he succeeded in making it do so), almost without exception improvement or cure began and steadily continued. this way patients with pulmonary tuberculosis lost, as a rule permanently, after a few injections, the pains which some of them had had in the chest for many years, also their night-sweats, hemoptysis, expectoration, fever, etc.; and appetite returned. Glands which had suppurated for a long time and fistulas from bones had completely healed. Joint tuberculosis also had been gradually but completely cured. Bladder and renal tuberculosis was markedly improved and also cured. Even lupus foci which had persisted for decades showed a progressive cure, and scrofula eruptions on the skin which had continued for many years in spite of all kinds of treatment healed completely without any other treatment. After the results of the treatment were repeatedly proved and the complete harmlessness of it was shown, children from tuberculous districts, who were constantly exposed to the danger of infection, have been treated, some soon after birth, with prophylactic purposes in view. All the 330 children so far inoculated, whose continuous good development is diagnosed by authoritative specialists, have borne the inoculation, which was performed over a year ago, without the least harm; they are in fine health, free from any indication of scrofula or tuberculosis.

In the discussion that followed in the medical society several speakers reported the effects which they had observed. Thus Prof. E. Müller has seen good results in children with bone and joint tuberculosis. Professor Schleich and others reported similar observations. On the contrary, the laryngologist Professor Heymann ex-

pressed himself with some reserve. In severe cases death could not be prevented, in others he observed improvement bordering on cure. Professor Blaschko reported that in skin lupus, with the exception of one case, the results were not successful, but that in cases of another kind of skin tuberculosis, which have been treated only recently, the result is so far good. J. Citron and G. Klemperer thought that the use of avirulent bacilli is dangerous inasmuch as for some not yet known reasons they are liable at any time to become virulent. prophylactic effect persists, they said, only so long as the bacilli remain alive within the body; therefore it is of little importance to infants for their later life. Professor Goldscheider complained that the description of the present conditions in the patients treated, especially of those with pulmonary tuberculosis, was not complete enough, at least the results of the inoculations are doubtful. Professor Orth called attention to the fact that although the guinea-pigs treated lived longer, yet they all finally died of tuberculosis.

Mixed Vaccines. In the opinion of W. H. Watters,7 patients whose temperature is below 100° F. are favorable subjects for the use of tuberculin, but when the temperature is above 100° F. there is probably a secondary infection, for which the proper remedy is a suitable vaccine. He concludes that if the patient is doing well under routine treatment his chances for doing better will be much increased, probably doubled by the use of a vaccine. If he is not doing well under routine treatment he should receive the vaccine by all means, as, even in hopeless cases, it may prove palliative and possibly curative as well. He recommends tuberculin and the vaccines, if necessary, for various other forms of tuberculosis, such as osteomyelitis, enterocolitis, renal tuberculosis, mesenteric tuberculosis, lupus and tuberculous meningitis.

[The assumption that the higher temperatures in tuberculosis are due to a mixed infection is unsupported by much clinical evidence. Infection with tubercle bacilli is capable of producing high fever in the absence

<sup>(7)</sup> N. Y. Med. Jour., Feb. 24, 1912.

of other organisms. As will be seen from other communications in this volume, mixed infection, although it undoubtedly occurs, is a rare event in the course of phthisis.—S.]

On the basis of very favorable results in two cases, G. Sanders's recommends the use of combined vaccines, consisting of the following:

Streptococcus, multivalent. 50,000,000 To each cubic centimetre vial. Colon, multivalent......200,000,000

One-half of this quantity is injected hypodermically into any portion of the body. Used every other day, from four to ten injections seem to bring definite results. In brief, the prostration, night-sweats, fever and debilitating condition of a patient having pulmonary tuberculosis, are considered to be due to a secondary infection, and by mitigating or removing the secondary infection, thereby increasing the vitality of the patient and also his resisting powers, we may accomplish a rapid cure of the tuberculosis. For this purpose the combined vaccines are injected.

**Spengler's I. K.** G. N. Ryan<sup>9</sup> reports the results of 43 cases of tuberculous infection treated by Spengler's I. K.

1. In "I. K." therapy Carl Spengler has given us the most effective agent in fighting tuberculosis that has come within our observation.

2. Perceptible lysis may be obviated in a number of cases by adopting the slow method of immunization.

3. The first signs of improvement are found in the subjective condition, lowering of temperature, increase of appetite, freer respiration if dyspnea is present, increase in weight, more restful sleep, decrease in cough, sputum and tubercle bacilli; also disappearance of râles, generally during the first few weeks.

4. It has been our experience that the toxic pulse persists for some time after the disappearance of other symptoms.

<sup>(8)</sup> N. Y. Med. Jour., Nov. 11, 1911. (9) Jour. Iowa State Med. Soc., Jan. 15, 1912.

5. In moribund patients its value has been chiefly in rendering them more comfortable.

6. Acute colds (to which these patients are highly susceptible) and other complicating diseases must be

dealt with according to indications.

O. Baer disputes the assertion of Kirschenblatt that Spengler's I. K. is of service in advanced cases of tuberculosis, even if its value in the early stages of the disease cannot be demonstrated. Baer reports 11 cases in which unfavorable results were presented. In addition to loss of appetite and of weight, he found an increase of cough, expectoration and of tubercle bacilli in the sputum, and in several cases the bacilli, which had disappeared under some months of ordinary treatment, reappeared. Râles became moister and more numerous and pleuritic pains were more noticeable. The symptoms were aggravated in other ways, and one patient developed epileptic attacks. The objection that the epileptic convulsions were due to the injections in a susceptible patient is refuted according to Baer by the fact that the patient had previously received morphine injections without showing any convulsive tendency. This unfavorable opinion of the remedy is sustained by a number of previous reports.

Marmorek's Serum. J. P. Mitchell<sup>2</sup> reports the results of the use of Marmorek's antituberculous serum in 10 cases and concludes as follows:

1. There is no danger in administration apart from anaphylaxis, which can be overcome by adopting the rectal method.

2. In certain cases the general improvement is most striking, although physical signs are not altered to a similar extent.

3. The undoubted success obtained in some of the cases justifies further clinical trials.

Maragliano's Vaccine. Duquaire<sup>8</sup> has been at work for two years with Maragliano's vaccine, and reports its use in 5 cases as a preventive and in 40 others as a cura-

Berlin, klin. Wochenschr., Jan. 29, 1912, Brit. Med. Jour., Feb. 10, 1912, Zentralbl. f. Inn. Med.

tive remedy, his conclusions being favorable. It acts like a tuberculin, but its mode of application is simpler. being a single application like vaccination against smallpox. There was never any febrile reaction, but in about four months, he says, under its influence a condition of active immunity developed. The vaccine is made from human tubercle bacilli first rendered more virulent by passage through guinea-pigs, then killed by heat and triturated. Duquaire applied the vaccine at three points on the arm or leg, after scarifying, the same as for small-pox vaccination, scarifying at another point for control.

A Chemical Therapy. Following the investigations of Finkler, his assistant, the Countess of Linden,4 has made a number of experimental investigations in the effort to find a chemical therapy for tuberculosis similar to that discovered by Ehrlich for syphilis. The experiments were made chiefly with two preparations the composition of which is not definitely revealed. The first preparation is an iodin compound of methylene blue and the second a copper salt of lecithin. It is claimed that the iodin compound of methylene blue colors tubercle bacilli and exerts a bactericidal action upon them. Furthermore, the experiments of v. Linden seem to show that when an animal infected with tuberculosis is treated with this preparation a specific attraction is exerted upon it by the tubercles which, while colorless before exposure to the air, assume a bluish color after such exposure. In the author's experiments with the copper salt similar results were obtained. Experiments upon animals infected with tuberculosis to which these preparations were administered showed in general a longer duration of the disease in the treated animals, and the necropsy indicated either a disappearance of the previous tubercles or else that the infection had not occurred. Apparently the evidence of virulence or of actual infection in the treated animals is deficient.

The method appears to be harmless and these preparations have been tried by E. Meissen<sup>5</sup> and by A. Strauss<sup>6</sup>

Beiträge z, Klin, der Tuberkulose, B. 23, H. 2. Ibid. Ibid.

on patients with pulmonary and local tuberculosis. Meissen's experience leads him to believe that the disease follows a more favorable course in the cases treated with these preparations than in those treated in the ordinary way. Strauss obtained very good results in surgical tuberculosis and seems much in favor of the copper treatment. He found, however, that for the most part patients could bear copper chlorid, so that the proprietary remedy which is about to be put on the market seems unnecessary even if the treatment should prove as favorable as its authors believe.

Iodin. Nieveling gives the following results of his observations in the use of iodin for pulmonary tuberculosis: 1. Iodin acts as a powerful expectorant in almost all cases. The previously tough mucus becomes more liquid and can be expectorated more easily. 2. The dyspnea that is present in most cases is very favorably influenced by iodin. 3. The heart action becomes stronger and palpitation is relieved in many cases. 4. No influence on the fever can be demonstrated. In such cases the iodin treatment completely fails. 5. Iodin seems to influence favorably the cicatrization and induration of tuberculous foci in the lungs, or at least to hinder the destruction of tuberculous tissue. The author regards this remedy as preferable to creosote.

Iodoform. W. M. Crofton<sup>8</sup> refers favorably to iodin given in chemical combination. The form which he has used for several years is iodoform, given intravenously, intramuscularly and by the mouth. The intravenous method is by far the most potent and is the method introduced by Dewar and Dunblane. It is given in quantities of from ½ to 1 gr. dissolved in ether, with a little liquid paraffin added, two to five times a week. The veins usually selected are those of the antecubital fossa. The little operation is quite a simple one. There is no pain or inconvenience to the patient, except a certain amount of coughing, and yet no procedure in medicine raised more à priori objections to its use, the bugbears imagined being embolism, thrombosis, gas

<sup>(7)</sup> Berlin. klin. Wochenschr., Oct. 14, 1912.
(8) Brit. Med. Jour., Veb. 10, 1912.

embolism from ether vapor, in fact the immediate demise of the patient. No such accident has ever occurred.

Higgins, of the Biological Laboratory, Ottawa, injected rabbits intralaryngeally with virulent bovine bacilli. He then waited until the rabbits, by loss of weight, etc., showed evidence of the disease, and began injecting daily 1-60 grain iodoform in ether into the auricular vein. For the first week the animals lost weight, but then began to put on as much as 25 to 50 gm. a day. When apparently well the lungs were examined, and it was found that the areas where the disease had been were completely replaced by healthy fibrous tissue.

Crofton relates two cases of recovery from acute miliary tuberculosis of the lungs, which he saw in consultation and in both of which the diagnosis was agreed to by eminent clinical authorities. The first was a man, aged about 35, who had been feeling ill for about three weeks. He had a patch of congestion in the lower lobe of his right lung, and fine crepitations over both lungs, with dyspnea, cyanosis and a rectal temperature ranging from 102° to 104° F. After the treatment commenced the temperature came down gradually and at the end of three months was normal. He has remained quite well ever since—that is, for three years—and is now in vigorous health.

The second case, a girl aged 20, had been ill somewhat longer, and the temperature sometimes reached 106° F. Her symptoms and physical signs were almost identical with those of the first case. It is now just a year since she was first seen and her temperature is normal and she is rapidly gaining weight and strength. Crofton reports three cases from his own practice.

The only fact absolutely known as to its action is that it causes a leukocytosis. Dewar suggests several explanations, two of which are that the iodoform may act unchanged, that it may be split up, oxygenation of the CH group producing formaldehyd, the iodin being liberated, and both acting directly as germicides. It is quite likely that the iodoform is split up, for iodoform in solution in ether is very unstable, being rapidly decomposed, for instance, by light, with the liberation of iodin.

Creosote. M. Fishberg<sup>o</sup> concludes that creosote is indicated in all cases of tuberculosis characterized by profuse expectoration derived from a pulmonary lesion, or its concomitant bronchitis or tracheitis. In these cases we can often expect a diminution in the cough and the amount of mucus or pus expectorated; increase in the appetite, gain in weight and an improvement in the general condition of the patient. The drug is contraindicated in all cases that expectorate little or nothing; in all febrile cases, and especially in those in which it provokes gastric disturbances. Albuminuria is another contra-indication, as is tachycardia and a tendency to hemorrhages from the lungs.

When intelligently used, creosote is one of the best drugs we have for the relief of the symptoms which are often difficult to relieve otherwise in intractable cases of

tuberculosis

Trypanosan. Lewaschoff reports his experience with trypanosan in pulmonary tuberculosis. The preparation was originally given him by Ehrlich, exclusively for the treatment of typhus fever. It belongs to the triphenylmethane group, and is less poisonous but has a more active bactericidal effect than parafuchsin.

Lewaschoff reports a series of cases of pulmonary tuberculosis which had not responded to other medication but in which considerable improvement was manifest after the administration of trypanosan. The remedy was given in tablets containing 0.5 to 1.0 gm. (8 to 15 gr.) from four to eight times daily for weeks and sometimes months. Among the side-effects noticed, besides loss of appetite in a few cases, was the appearance of spots on the skin, resembling the measles exanthem, which, however, quickly receded. As to the effect of trypanosan in tuberculosis of other organs, the author has as yet had no experience.

Organotherapy. G. Schröder, K. Kaufman and H. Kügel<sup>2</sup> conclude: 1. Curative effects can be produced by the pulped spleen of animals immune to tuberculosis in

Amer. Practitioner, September, 1912. Russki Vratsch, 1912. Beiträge z. Klin. der Tuberkulose, B. 23, H. 1.

experimental tuberculosis. These effects consist chiefly in a connective tissue transformation of the disease focus. 2. Virulent tubercle bacilli are much reduced in virulence and even killed when kept in spleen pulp at even temperature. The solution of tubercle bacilli was not observed. 3. A diminution of the amount of antigen of old tuberculin could not be produced by spleen pulp or extract of spleen. No antituberculin appeared in the serum of animals treated with spleen pulp. 4. The action of the pulp on the lymphatic organs probably depends on its contents in lipase, soaps or oleic acid and lipoids. 5. Autolysis of the spleen pulp did not increase its activity. 6. Splenectomized rabbits were not reduced in their resisting power to tubercle of the human type.

Metabolic Treatment. The essential problem in the treatment of pulmonary tuberculosis and its complications is a metabolic one. It is around this central point that its pathology finds expression, and it is towards the correction of these various perversions that our present hygienic and dietary efforts are directed. It follows, therefore, that any therapeutic agent which will aid, however slightly, in time of need, a failing anabolism, which will diminish the toxemia, or which will modify a troublesome and debilitating complication, is worthy of inclusion in the list of what is at best an all too slender armamentarium.

In cases of functional diarrhea as well as in cases of actual tuberculous enteritis the employment of lactic-acid-soured milk has afforded the maximum benefit, both as a dietary measure in support of energy and in tissue repair, and as an agent favorably modifying the symptoms and controlling the diarrhea. In some cases not well defined it is contra-indicated. The urine of the tuberculous presents as a rule a varying degree of indicanuria.

Finding that many of the commercial tablets for the preparation of buttermilk were largely sterile, P. C. Bartlett and C. V. Murphy<sup>3</sup> resorted to the following preparation of lactic acid bacilli. Ordinary skimmed milk cultures were substituted for the tablets, according

<sup>(3)</sup> Boston Med, and Surg. Jour., Sept. 5, 1912,

to the following plan: After substituting sterile corks for the ordinary cotton plugs, the labels are marked with a future date—as indicating the time when the contained organisms might be assumed to have produced sufficient acid to affect their viability, and when the cultures, therefore, are to be renewed. The six-ounce bottles containing the cultures are sent from the laboratory to the pharmacy ice-chest, and from there distributed to the various wards as required. Here the cultures are kept on ice, and for use a dram or more of the buttermilk is stirred into a few ounces of solution of milk sugar, care being exercised to avoid contamination of the stock supply. The ingestion is thus insured in a suitable carbohydrate medium—an essential accompaniment lacking in the case of the tablets-of many more live, active lactic acid bacilli than a dozen tablets could under the most favorable circumstances supply. taste of the mixture is at most no more objectionable than that of the average prescription, in which a sirupy menstruum is employed.

These preparations, however, frequently produced a buttermilk of inferior quality. It sometimes had a fecal The following is the reason assigned for this inferiority: The factor of first and highest importance was the absence of a biologically active culture of the milk-souring bacillus, capable of producing at room temperature—70° F.—when implanted in reasonably small numbers, in a milk medium, a growth of sufficient activity to inhibit by the free production of lactic acid the development of such organisms as are originally present in the milk, and escape death during subsequent pasteurization. This is a requirement to which very few strains of lactic acid bacilli can conform. Only through the process of subculturing for a considerable period in a milk medium at the required temperature can a given strain of lactic acid bacilli, carefully selected at the beginning, be educated to the point of producing a sufficiently free growth, accompanied by an adequate liberation of lactic acid, for employment in the routine production of buttermilk. Repeated strains obtained through the various commercial sources have failed of utility because of their noticeable feebleness of development.

The usual directions are to place the milk in a warm place over night, following inoculation. The diet-kitchen in which Bartlett and Murphy formerly incubated the buttermilk was steam-heated and equipped with a range in which the fire was allowed to smolder during the night, so that the thermal conditions may be regarded as average ones.

Briefly then, the factors which render impracticable the preparation of large quantities of buttermilk under what may be termed home conditions may be summarized as follows:

1. The difficulty in obtaining a reliable strain to be used as a starter.

2. The fact that certain undesirable organisms—even lactic-acid producers—giving rise to an unsightly butter-milk of unpleasant taste, may, under favorable temperature conditions, multiply at the expense of the bacteria introduced.

3. The difficulty of maintaining in the home a fairly constant temperature of about 70° F.

4. The fact that when the Bulgarian bacillus is used, a temperature close to 98.6° F. is necessary; and that even when the milk is successfully soured by this bacillus the resulting excessive acidity, and the almost sirupy, sticky consistency of the milk, is obnoxious to most patients. If employed in connection with the Streptococcus Lebenis, the latter fails to develop actively at the temperature required for incubation of the Bacillus Bulgaricus; and if exposure to 70° F. is employed, the streptococcus becomes the principal factor, the Bulgarian bacillus developing feebly, or not at all. As a matter of fact, in actual practice the Streptococcus Lebenis soon dies out, leaving behind its more resistant companion.

For the routine handling of stock cultures in the laboratory three varieties of containers are necessary, fresh separator-skimmed-milk being the medium employed. At least four and preferably five days' sterilization by the fractional method, with a daily exposure of 45 minutes, is essential to escape subsequent overgrowth

by the spores of extremely resistant organisms originally present in the milk, with all the troublesome contaminations which such occurrences entail. They may fail to develop during storage of the media in the ice-chest, but appear upon incubation, and possibly spoil an entire lot of buttermilk. A safe guide, useful in the experience of the authors, is the caramelization of the milk-sugar, which occurs only, as a rule, after long and repeated sterilization at 212° F.—usually upon the fourth or fifth day. The media are prepared, according to the above directions, in ordinary culture-tubes, in four-ounce prescription bottles having a mouth of average diameter and in flasks similar to those used for the buttermilk.

Intrabronchial Treatment. A. Ephraim<sup>4</sup> describes his method of intrabronchial treatment. By means of the bronchoscope, under the direction of the eye, a spraytube, either straight or bent backward at the point, is introduced into one of the large bronchi or into one of the single branches. Introduction into a branch of the lower lobe as well as into the right upper and middle lobe is easy for a practiced physician. In the left upper lobe introduction is usually possible only with strong pressure. In this connection it may be noted that the indications for the treatment of the upper lobes are quite rare. More frequently the introduction of the spray-tube into the chief bronchus is sufficient for medication in the frequent diffuse affections of the bronchi or in those limited to the lower lobe. This introduction may be made in a way which is much less troublesome to the patient than the introduction of the bronchoscope, and it is also practicable without special previous experience for any physician who is capable of introducing a probe into the larynx under the direction of the eye.

After anesthetizing the glottis and trachea a flexible spray-tube is introduced with the assistance of a cannula, and carried with certain movements of the body either into the right or the left bronchus at will. The situation of the instrument is determined, on the one hand, by auscultation of the loud murmur which is pro-

<sup>(4)</sup> Deutsche med. Wochenschr., Nov. 9, 1911.

duced by air or oxygen blown in on the affected side, and, on the other hand, by the help of the centimeter scale which is engraved on the instrument. When this determination has been made the medicated liquid is sprayed in, during which time the instrument may be slowly moved up and down in order to reach as large a field as possible.

As motor power for the spray one may use a powerful double bulb for hand use or compressed oxygen. If oily liquids are used a much stronger pressure is necessary than the hand instrument can supply. The pressure applied for the production of the spray must not be too small if the smaller bronchi are to be reached. The author selects such a pressure that the cloud of fluid in a horizontal position of the spray-tube can be recognized at a distance of 75 cm. This corresponds to a pressure of about 30 cm. of mercury. The pressure of the cloud of liquid is incomparably smaller, and will be borne by most persons without any reaction, provided that the spray-tube is so narrow that it does not nearly fill the lumen of the bronchus. The author has never seen any influence on the mode of respiration by the spray, but in many patients there has been slight cough, which required a reduction of the pressure. As a rule narcotics are not necessary for carrying out the process. Only in patients who suffer from a constant severe cough or are otherwise very sensitive it is recommended that a moderate dose of morphine be administered previous to the operation.

Suction Mask. Berlin<sup>5</sup> concludes an exhaustive investigation of the action of Kuhn's suction mask in 52 cases of pulmonary tuberculosis in which the diagnosis was exactly and certainly determined by x-ray examination, and the patients kept under observation for 10½ months. The treatment was thoroughly tried in all respects with the following results:

1. The treatment with the mask is subjectively well borne and willingly undertaken by the majority of patients with pulmonary tuberculosis. However, in

<sup>(5)</sup> Beiträge z. Klin. der Tuberkulose, July 26, 1912.

warm weather the perspiration and the eczema caused

by it may occasion considerable inconvenience.

2. The general condition of patients treated with the mask improved in most cases, but not more than is usually the case as the result of hospital treatment. Especially the increase in weight is to be attributed to the hospital care, and especially rest cure, and not to the mask.

- 3. The hypnotic action of the mask was not evident in all cases, nor was its appetizing influence always shown.
- 4. The chest circumference increased in all those treated with few exceptions, the highest increase amounting to 8.5 cm. (3.4 in.). In general the increase was greater in children and young adults than in older individuals. In these cases the increase of the subcutaneous fat should be taken into consideration.
- 5. Defervescence did not occur in all cases after the mask treatment. The effect of the combined mask treatment and the rest cure is no greater than the action of the rest cure alone.

6. The frequency of respiration is almost regularly reduced by the mask treatment in combination with the

rest cure. In many cases dyspnea disappeared.

7. In a number of patients thus treated cough and expectoration completely disappeared; in many others they were more or less reduced, and only in exceptional cases they remained uninfluenced. In this respect no difference could be noted in favor of any particular stage of pulmonary tuberculosis. The impression was gained that improvement in these respects occurred more rapidly in patients treated with the mask than in others who had merely the ordinary treatment combined with the rest cure. Nevertheless subsequent inquiries showed that the influence was not lasting.

8. No evidence was secured of the power of the mask to destroy or lessen the number of the tubercle bacilli.

9. The respiratory murmur and percussion findings are uninfluenced by the mask aside from cases with pneumonia with poor resolution. Catarrhal murmurs in most cases of the second and third stages are not

diminished in number and only seldom in the first stage. Still a noticeable aggravation was observed in a number of cases in all three stages, inasmuch as parts of the lung hitherto free from disease showed the involvement of fresh foci. The assumption of Kuhn that the mask is harmless in all cases Berlin cannot support. Kuhn himself lately holds that the mask is indicated only in the first stage and, indeed, only for those that are completely free from fever.

10. Especially the cases of the first stage of pulmonary tuberculosis for which Kuhn of late holds the mask to be indicated have not been influenced favorably by this treatment in any essential degree, and in part they have become worse. A simple fresh-air rest cure would doubtless have accomplished much more on the average and in a shorter time.

11. In all cases in which softening has occurred the mask is contra-indicated because, by the inspiratory tearing or stretching of the pathologic tissue, dissemination of the bacilli may be caused.

12. The mask is no certain prophylactic against hemorrhages; in some cases hemorrhage occurred during the mask treatment though power proviously.

the mask treatment, though never previously.

13. So far as an opinion can be formed from three cases, pleuritic exudates are not absorbed more quickly under the mask treatment than under ordinary therapy.

14. Examination of the blood has shown that the amount of hemoglobin is increased in the majority of cases, but that the action of the mask in increasing the number of erythrocytes is very uncertain.

Subcutaneous Injections of Oxygen. R. Bayeux<sup>6</sup> advocates the injection of oxygen subcutaneously, a procedure which he has adopted in 36 cases during the past eighteen months. He makes the injections in the lower part of the trunk, in quantities rarely exceeding a pint a day, repeating the injections every three days.

Artificial Pneumothorax. Twenty-eight cases of phthisis have been subjected by S. Robinson and C. Floyd' to artificial pneumothorax therapy within the

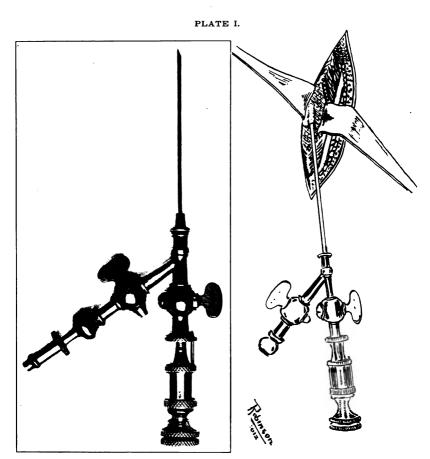
<sup>(6)</sup> Arch. gen. de Méd., September, 1912. (7) Archiv. Int. Med., Apr. 15, 1912.



past two and one-half years. With three exceptions all of the cases have been advanced ones which had previously failed to respond to methods of therapeutic hygiene. The last 8 cases have been treated by nitrogen injection too recently to draw conclusions as to the ultimate result of the treatment. It is said, however, that with the exception of the 3 cases in which a pleural space could not be established, a distinct relief of symptoms has been the immediate result of the lung compression in practically all of the reported cases of the series. The tuberculous process has been brought to a standstill in at least 6 of the cases which have been under constant observation and continued treatment. In 2 instances there has been cessation of all activity in both lungs. The promptness and willingness with which most of the patients responded to summons for repeated injections were regarded as conclusive evidence at least of the symptomatic relief attending the therapy. This might have been credited in part to psychic influences, had there not been a corresponding improvement in the objective signs revealed by repeated examinations.

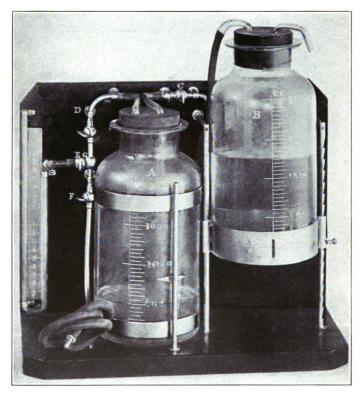
From experience with the earlier cases the authors have been led to the employment of more frequent injec-They believe that this factor is of paramount importance. The completeness of the compression is thus more nearly attained; furthermore, the partial mobilization of the lung permitted by the absorption of the nitrogen is promptly prevented by its early renewal. The fatalities recorded were due to the unarrested progress of the disease in certain of the more advanced cases. In no instance was death referable in any way to the pneumothorax therapy. They believe that "pleural eclampsia" (Forlanini), or a reflex inhibition of the heart through vagus irritation from the pleura, is a danger to be considered in this treatment as in other therapy requiring thoracentesis, but that it may always be prevented by anesthetizing the pleura. They have experienced no accidents, and believing that they are always avoidable. conclude that pneumothorax therapy is a safe procedure.

Induced Pneumothorax in Pulmonary Tuberculosis. F. Klemperer's experience confirms the practical impor-



Incision method of nitrogen injection. Transparent parietal pleura exposed, showing non-adherent lung beneath it. Needle inserted at an oblique angle to avoid lung injury.—S. Robinson and C. Floyd. (Page 108.)

### PLATE II.



Robinson's artificial pneumothorax apparatus. (Page 103.)

tance of this method of treating severe unilateral tuberculous lesions. He reports 4 cases and discusses the special indications and technic, regarding it as not a particularly serious or dangerous method of treatment. He would restrict it to cases in which the disease does not seem to be arrested by the ordinary measures, including tuberculin treatment, but continues a slowly progressive course, not waiting, however, until the lesion has entered its final phase. The best results have been obtained in the moderately severe cases in a comparatively early stage.

Samson<sup>8</sup> declares that in a certain number of cases the induced pneumothorax produces results unattainable by any other measure, and he urges its wider adoption in many otherwise incurable cases of tuberculosis. ascribes the first suggestion of the procedure to the English physician Carson, in 1821; adding that Dauss rescued the suggestion from oblivion, but Forlanini in Italy and Murphy in America suggested it anew and applied it in practice. Samson has applied the method in 7 cases, making seventy injections of nitrogen in all, his experiences confirming those reported by other The most striking and direct effect is the subsidence to normal of the temperature; the expectoration is also promptly and materially reduced; the pulse becomes slower and the tendency to cyanosis and hemoptysis is no longer observed. Some writers have reported apoplectiform symptoms during the puncture; Forlanini regards them as a reflex neurosis, a "pleura shock" or "pleura eclampsia," but Samson thinks that the trouble is due to gas embolism which can be avoided by a preliminary incision rather than blind puncture.

Technic. S. Robinson and C. Floydo discuss the technic of artificial pneumothorax which they have practiced in 28 cases of phthisis, most of which were far advanced and had failed to respond to other forms of treatment. The choice of the point of injection is made simply on the principle of entering the pleural cavity where there are least likely to be adhesions which may hinder the entrance of the gas. Two methods are in vogue; in

 <sup>(8)</sup> Berlin. klin. Wochenschr., Dec. 18, 1911.
 (9) Archiv, Int. Med., April 15, 1912.

that of Brauer a preliminary incision through the skin and fascia is made in an intercostal space and the needle is passed into the pleural cavity under the control of the eye as the outer layer of the pleura may be seen. In the method of Forlanini a special needle is plunged through the skin, fascia and outer parietal pleura until the sensation of the directing finger indicates that the pleural cavity has been reached. (See Plate I.)

Anesthesia is obtained by freezing the skin with ethyl chlorid and then anesthetizing the tissues with a solution of novocain, 1 per cent., and epinephrin, 1 to 10,000. In Brauer's method the needle may be introduced and the nitrogen injected without further testing, but in the method of Forlanini the following test should be applied to determine whether the point of the needle is really in

the pleural cavity:

When the needle has been introduced to what digital sense would indicate to be the correct depth the trocar is removed and the needle cock closed. The manometer is connected with the needle and isolated from the nitrogen apparatus. The needle-cock is then opened and the negative pressure of the pleural cavity is indicated by the manometer. This pressure varies with expiration and inspiration, being from 0.5 to 3 or 4 cm. If no negative pressure is indicated by the manometer the needle has not entered into a free space in the pleural cavity. Gas should not be introduced under these circumstances until an adjustment of the needle indicates that it is safely in the pleural cavity. If changes in the position of the needle do not result in a positive manometer reading, even when the patient is requested to breathe deeply, ample proof is present that a pleural space and pneumothorax cannot be established at this point and the needle should be withdrawn and another area selected.

The apparatus is now adjusted so that the manometer is cut out and the nitrogen bottle connected with the needle, and the gas allowed to flow in under a pressure not exceeding 12 cm. of water. Under a pressure of 6 to 10 cm. the gas enters at the rate of 50 c.c. per minute. From 500 to 1,000 c.c. may usually be introduced at the first injection if there are no adhesions that limit

the extent to which the pleural cavity may be enlarged, and the lung compressed. Adhesions to the diaphragm or to the parietal pleura may cause pain when stretched. The onset of distress and the first sign of pain should be accepted as sufficient reason for removing the needle, not only at the first injection but also in subsequent ones. A month or six weeks may be allowed to elapse before the second injection, when usually a larger amount may be injected without pain than at first. The authors have been led to the employment of more frequent injections. This factor they regard of paramount importance. The completeness of the compression is thus more nearly attained; furthermore, the partial mobilization of the lung permitted by the absorption of the gas is promptly prevented by its early renewal.

Apparatus. The authors described two pieces of apparatus for these injections. These are an injection needle devised by Floyd and a manometer and gas bottles arranged by Robinson for injecting nitrogen under constant pressure. Two bottles of 3,500 c.c. capacity are employed. One is stationary and one filled with water containing 2 drams of pyrogallic acid to take up any oxygen which may enter in conjunction with nitrogen. Nitrogen gas is then formed into the stationary bottle (A), displacing the water back to bottle B. At completion of this displacement the apparatus is ready for use. On opening certain cocks the water in bottle B replaces the nitrogen in bottle A, gradually filling it. The difference in the water level of the two bottles represents the pressure under which the nitrogen is injected, the rapidity of its injection being regulated by the size of the opening in any one of the cocks. When bottle B is full the maximum pressure is obtained, amounting to about 14 c.c. of water. As the water levels approach one another bottle B may be raised as in Plate II, thus maintaining the pressure until most of the nitrogen has been displaced, when the pressure is necessarily reduced. With this hydrostatic mechanism the pressure may be varied at will, never attaining the dangerous limit.

The arrangements of cocks d, e and f correspond to the substitution of a three-way cock at point g. In other

words, with cock d closed and e and f open, a direct connection is established between the thoracic cavity and the manometer. With cock f closed and c, d and e open, connection is made between the confined nitrogen and the manometer, thus recording the pressure represented by the difference in water levels of bottles A and B. With cock e closed and all others open, the nitrogen passes directly from bottle A into the pleural cavity.

Mary E. Lapham¹ describes the technic of the operation. She uses an apparatus which procures nitrogen by exhausting the oxygen of the air by the combustion of ethyl alcohol. The carbon dioxid produced is absorbed by passing the mixed gases over potassium hydroxid, and the residual nitrogen heated to sterilize it and passed into a vessel from which it is injected as in other methods.

The great danger in the use of the method comes from emboli. These are of two kinds: gas emboli caused by the entrance of air or nitrogen into the circulation and emboli from the expulsion of a clot from the pleural circulation or the pulmonary. The author warns against the dangers of gas embolism which may occur if the needle penetrates a blood-vessel, and may be followed by collapse and sudden death. This is to be avoided either by an x-ray examination to make sure of a sufficient pleural cavity, or by noting oscillations in the manometer readings corresponding to the respiratory movements.

It has happened that the manometer gave no excursions at first, but that after a few c.c. of nitrogen were introduced these excursions appeared in satisfactory force and a successful filling was made. This is always dangerous and should never be attempted. If the point of the needle is in a bronchus sufficiently large, or in the subpleural space, there may be fairly good excursions. If it is in a pleural band or a small pocket, there is a sharp rise of pressure. The piercing of a vein causes a good deal of pain, and with a stethoscope liquid sounds may be heard. In case death is delayed convulsions may

South. Med. Jour., February, 1912; also Month. Cycloped. and Med. Bull., October, 1912.

occur. Lapham makes the following suggestions as to treatment:

If the cause of the convulsions is the pressure of the gas emboli upon the motor centers, and the collapse phenomena are due to pressure upon the vital centers in the medulla, would it not be better to use strong ammonia and provoke coughing to drive on these emboli rather than to depress cerebral activity with morphine? In the cases of gas embolism reported morphine has been given to quiet the spasms, and one is tempted to inquire how much this secondary depression has had to do with failure to recover.

Absorption from the Pleura in Artificial Pneumothorax. W. Meyerstein instituted experiments to determine the effect of an artificial pneumothorax on the absorption from the pleural mucous membrane. He found that the presence of fluid and air in the pleural cavity had about the same effect on the activity of absorption from the pleural membrane. The absorption was not affected by small to medium amounts of either fluid or air up to the third or half of the capacity of the cavity. Larger amounts retarded the process, and the same was true of an open pneumothorax. The exudation is uninfluenced by an open pneumothorax as well as by a closed one in which the pressure is sufficient merely to collapse the lung. It is only after the introduction of amounts of gas sufficient to compress the lung that the exudation is diminished.

Some applications of the process are indicated. In simple serous pleural effusion the withdrawal of the fluid is apt to be followed by symptoms, due to the tearing or stretching of the collapsed lung. These symptoms are relieved by the introduction of air after the withdrawal of liquid. Such an injection of air also stimulates the absorption of the remaining liquid.

In large exudations, which sometimes must be left only partly evacuated, because of the pain resulting from stretching the lung, the simultaneous injection of gas enables the emptying of the cavity to be carried on more smoothly and more completely. An important

<sup>(1)</sup> Beiträge z. Klin. der Tuberkulose, B. 24, H. 1.

action of the gas injected consists in preventing the hyperemia which commonly occurs from the expansion

of the compressed lung.

Clinical Cases. Bochalli<sup>2</sup> reports 6 cases of severe pulmonary tuberculosis in which he employed artificial pneumothorax after the manner of Forlanini with good results. He tried at first the method of incision in an intercostal space before inserting a cannula, but later resorted to simple puncture, as he found that it was nearly always possible to find a space between the two layers of the pleura into which the gas could be injected. He used Saugmann's nitrogen apparatus and Saugmann's needle. The condition of the lung was determined by the fluoroscope both before and after the injection.

One case was practically cured; three were improved; two were regarded as hopeless from the beginning. While success is not to be expected in all severe cases, the results obtained after a practical failure of other remedies must

be regarded as very satisfactory.

From an experience with 40 cases Keller<sup>3</sup> concludes that artificial pneumothorax is a measure which promises beneficial results in cases of pulmonary tuberculosis to which it can be applied. In 6 of his cases he could not apply the remedy, and in 9 more it was impossible to secure the desired collapse of the lung. The most striking results were observed in cases with cavities in which it secures a complete change in the clinical picture by obliterating the place of formation of a large amount of toxins. The favorable influence of this measure is also unmistakable in cases with considerable infiltration, even of a pneumonic character. If the process is recognized as a severe and progressive one, the physician should not hesitate to apply the artificial pneumothorax. the author's opinion it is justifiable to sacrifice a large portion of the sound, although seriously endangered lung, rather than forego the opportunity of benefit from the use of a remedy which is recognized to be far more effective than any other at our command. Moreover, it

<sup>(2)</sup> Beiträge z. Klin. der Tuberkulose, B. 24, H. 1.
(3) Beiträge z. Klin. der Tuberkulose, B. 22, H. 2.

is not a question of loss of the sound tissue but rather one of its preservation at the cost of a temporary sacrifice of its function. Keller has seen no occasion to object to the treatment on account of action on the heart and circulation. In a case that came to necropsy the hypertrophy of the right heart sometimes observed in animals was not found; there was instead a brown atrophy. Keller believes that this remedy is also applicable in cases of bronchiectasis.

Mary E. Lapham<sup>4</sup> reports the use of artificial pneumothorax in 22 cases with the following indications for its use: Inability to arrest the process in 15 cases; inability to hold a previous recovery in 3 cases; impatience to return to work and unwillingness to risk the uncertainty of symptomatic treatment in 2 cases; while in another patient the operation was done on purely theoretical grounds; and one case was referred expressly for the treatment.

There were three deaths and one failure in the 15 cases, all of which were advanced and otherwise hopeless. One death was due to hemorrhage before the effects of the method could be obtained. This case was characterized by severe and persistent hemorrhages which constituted the indication for attempting the treatment. The second death was due to a violent exacerbation of an intestinal tuberculosis, together with an exaggerated course of tuberculin given after the patient left. The third patient left far too soon and was afterward not properly cared for. The patient who did not improve still has a chance of recovery. She is gaining slowly and is in every way much better than before the attempt was made. The pleural cavity is filled with adhesions and there is an enormous, almost malignant, development of the pleural collateral circulation. All of the others are doing well, and in all of them recovery could not have been made unaided.

Of the three patients unable to hold a recovery when made one has been earning his living for over a year without the loss of a day's work, and the other two are in equally favorable condition. There were two cases

<sup>(4)</sup> Amer. Jour. Med. Sciences, April, 1912.

of business men impatient to resume work, and unwilling to risk the slow and uncertain results of symptomatic treatment. It is too soon to prophesy, says Lapham, but the lungs of both are being successfully compressed, and she believes that within a year these men will return to work and be as free from the dread of a relapse as an anatomic recovery can make them.

In the opinion of E. O. Otis<sup>5</sup> in many cases, previously considered hopeless, artificial pneumothorax produced by the injection of nitrogen gas offers chance of arrest, and the increasing number of reported cases by men of the highest authority, and extending over a considerable number of years, has fully attested its value and established this treatment on the firm basis of successful experience. The procedure does not demand any great operative skill, but it requires careful manipulation in order to get in between the two layers of the pleura. If firm pleural adhesions exist, the lung cannot obviously be compressed, but it is surprising how infrequently this happens, even in very extensive disease. Not only in advanced tuberculosis, but also in abscess of the lung, bronchiectasis, and dangerous hemoptysis is the operation applicable.

In performing the operation a very careful determination of the exact condition of the diseased lung is made, and in every case the Röntgen-ray is used, particularly to ascertain whether or not pleural adhesions exist. Of course, it is evident that the other lung must, for the most part, be able to perform its function; not necessarily that its integrity should be complete, for there may be and often is a small amount of disease at the apex. Curiously and fortunately the artificial pneumothorax often exercises a beneficial influence on the diseased apex of the other lung, if it exists, and that, also, becomes arrested, the cause of which has been variously explained.

The conditions, then, which warrant a recourse to artificial pneumothorax are an advanced or advancing case of pulmonary tuberculosis which does not yield to the ordinary treatment, the disease being principally uni-

<sup>(5)</sup> Boston Med. and Surg. Jour., Oct. 31, 1912.

lateral. After a careful physical and Röntgen-ray examination, the spot which appears to be free from adhesions is selected, and, by careful manipulation, a needle similar to an aspirating needle is inserted between the two layers of the pleura and through it nitrogen gas is slowly injected under slight pressure. Only a certain amount of the gas is allowed to flow in at the first attempt, depending on individual conditions; and the procedure is repeated, if all goes well, at frequent intervals until the lung is tightly compressed, as shown by the physical examination and a Röntgen-ray picture. When this has been accomplished the subsequent injections are at longer intervals sufficient to maintain the compression.

Complications. P. G. Carlström<sup>6</sup> reports a case of his own and another communicated to him by W. Halahult, in which, after the production of an artificial pneumothorax, in one case on the right side and in the other on the left, hypertrophy and dilatation of the right heart was demonstrated at the autopsy. These appear to be the only cases in which this change in the heart has been noticed. The author thinks it should inculcate caution in producing pneumothorax, especially in young people and in cases in which a complete pneumothorax has been secured.

Hemoptysis and High Altitude. F. E. Meara and I. J. Biskind discuss pulmonary hemorrhage and its relation to high altitude. High blood-pressure is supposed to play an important rôle in causing pulmonary hemorrhages in tuberculosis, although a very large percentage of patients show quite a low blood-pressure before the hemorrhage and after. It would seem more plausible to assume that a steady elevation of the arterial tension would be a good deal less apt to cause a hemorrhage than would a sudden rise caused by a hard coughing spell or sudden fright and the like. It would seem that a steady high blood-pressure is a very small factor in causing pulmonary hemorrhages, from the fact that pulmonary hemorrhage is very rare in infancy and seldom met with in childhood, occurring most frequently at the

<sup>(6)</sup> Beiträge z. Klin. der Tuberkulose, B. 22, H. 2. (7) Cleveland Med. Jour., June, 1912.

ages of twenty to twenty-five years, although blood-pressure is not any lower in childhood than it is at the age of twenty or thirty. Living in a high altitude (according to the observations of Peters) elevates arterial tension, and yet the percentage of pulmonary hemorrhages at the different sanatoria is a good deal lower than in the lower altitudes, where the blood-pressure is supposedly lower. There must be some factors other than blood-pressure which help produce pulmonary hemorrhages. Arteriosclerosis and heredity are minor factors.

Klebs has observed that close, damp weather, with low barometric pressure, is apt to produce hemorrhages,

which may come in epidemic-like spells.

The authors believe that the discipline of the sanatoria is influential in lessening the percentage of hemorrhages. The altitude and climate are also important. The air should be fresh, but not very cold, with a steady temperature. Furthermore, according to the recent work of Webb, continuous residence at high altitude invariably increases the number of mononuclear lymphocytes, which, according to later investigators, are combating the Koch's bacilli. It is an undisputed fact that there is an increase in the erythrocytes from five million to eight million in high altitude.

Treatment of Hemoptysis. C. Gueit<sup>8</sup> classifies the indi-

cations in the treatment of hemoptysis as follows:

A. Indications drawn from anatomy and pathology. These are to act on the walls of the vessels to favor the coagulation of the blood and to modify the intravascular tension. These indications are met by the ordinary coagulants, such as calcium lactate, sodium sulphate, physiologic serum, gelatin, fresh rabbit serum, hepatic extract, adrenalin, amyl nitrate and nitroglycerin. Of these he recommends especially gelatin, calcium, and adrenalin or nitroglycerin. Gelatin he gives in from 1 to 5 per cent. solution in physiologic salt solution. He also has used a mixture of gelatin and sodium sulphate, pure gelatin, 2 gm.; sodium sulphate, 1 gm.; distilled water, 100 c.c. Of this, 20 to 100 c.c. are injected beneath the skin. The injection is not painful.

<sup>(8)</sup> Gaz. des Hôp., Sept. 26, 1912.



Indications derived from the cause. In the first stage the hemoptysis is due to congestion and should be treated with a strict diet, rest in bed, and disuse of the voice. Ice or a poultice should be applied to the apex of the lung. In this form extract of mistletoe is indicated in pills of 10 cgm. (1½ gr.) every six hours, with warm enemata. When there is a supplementary hemoptysis one should re-establish the normal flow, and avoid the recurrence of the accident by prescribing hot footbaths before the return of the menses, and morning and evening capsules of apiol or gossypiol. The hemoptysis of the second stage is benefited by vasoconstrictors, and more especially by ipecac and tartar emetic. In the third stage recourse should be had to gelatin or rabbit or horse serum. In certain cases injections of epinephrin (adrenalin) may render good service. Recourse may be had to ligature of the fore limbs or artificial pneumothorax may be tried. The head should be placed low, ice applied to the chest, and absolute rest imposed.

# PNEUMONIA.

# ETIOLOGY.

Experimental Pneumonia. R. V. Lamar and S. J. Meltzer\* succeeded in producing by intrabronchial insufflation of pure cultures of pneumococcus in dogs, an experimental pneumonia successively in 42 cases, with a mortality of at least 16 per cent. The fatal cases resembled closely lobar pneumonia in man. In the nonfatal cases the pathologic and bacteriologic findings were again in accord with the findings in man. Clinically, however, the cases of non-fatal experimental pneumonia run a milder and shorter course than in man. In a few instances, lobar pneumonia has been produced experimentally also with the Pneumococcus mucosus and with Friedländer's pneumobacillus. The anatomic findings in these experiments have shown some characteristics agreeing with the findings in the pneumonias of man produced by these organisms. The quantity of the in-

<sup>(9)</sup> Jour. of Experi. Med., February, 1912.

jected culture seemed to have a definite influence on the outcome of the disease; in the fatal cases larger quantities of the culture had been injected. The animals were neither selected nor prepared in any manner. The experimental success did not, therefore, appear to depend on the degree of resistance of the individual hosts. It is suggested that the uniformly successful results of the experiments were due to the obliteration of a large number of bronchi by the injected culture, through which mechanical effect a favorable opportunity was provided the pneumococci to develop and display their pathogenic activities, consisting in the calling forth of a characteristic local, more or less effective, widespread,

inflammatory reaction of the lung tissue.

Phagocytic Pneumonia. E. C. Rosenow makes the following observations on phagocytic immunity in pneumonia: The reason why non-virulent pneumococci are not able to cause infection seems to be due to their prompt destruction by leukocytes when injected into animals. Virulent pneumococci, on the other hand, are resistant to phagocytosis in vitro and when injected into This resistance to phagocytosis seems to be due to a substance, "virulin," which goes into the sodium chlorid solution during autolysis. The pneumococci from which it has been extracted are now able to absorb opsonin from serum and are rendered phagocytable, while the part which goes in solution neutralizes opsonin and is taken up by certain strains of non-virulent pneumococci, rendering them relatively resistant to phagocytosis and virulent again. It has been shown that the pneumococcidal power of pneumonia or other leukocytic blood is proportionate to the number of leukocytes present and the opsonic power, and is due to phagocytosis and intraleukocytic destruction. Potter and Krumwiede, De Marchis (F.) and others have shown that the opsonic index to pneumococci, while below normal early in pneumonia, is above normal and at its greatest height at about the time of crisis in cases with a favorable termination, while in overwhelming infections the index remains persistently low. Observa-

<sup>(1)</sup> Ill. Med. Jour., April, 1912,

tions on the opsonic index during experimental pneumococcus infections in animals show a similar course—in those which recover the index goes well above normal after a nearly negative phase, while in those which succumb it remains persistently below normal. From these observations it is clear that the opsonic index may be looked on at least as an index of resistance offered by the infected animal.

As further evidence in favor of this form of immunity in pneumonia Rosenow has found that leukocytes from pneumonia during active leukocytosis are not only more active phagocytically, taking up more pneumococci than normal leukocytes under the same conditions, but they take up pneumococci of a higher grade of virulence. Tunnicliff, in an extensive study of this point, has found that the phagocytic power of the leukocytes in mild cases of pneumonia is increased. In severe cases, on the other hand, it is diminished while the severe symptoms are present, but when the patient improves it rises above normal. Eggers (personal communication) has very recently shown that there is a very close relation between the antipneumococcal (phagocytosis and intraleukocytic destruction) power of the blood and the clinical symptoms in pneumonia.

Neither sera nor vaccines have given results of marked value. Rosenow has, however, been able to separate from virulent pneumococci a large part of the toxic material which goes into solution on autolysis and yet have left in the pneumococci that part which stimulates antibody formation more promptly and more energetically without first producing a negative phase. The number of "detoxicated" or autolysed pneumococci inoculated can now be much greater than those merely killed by heat. When this material is inoculated within forty-eight hours after the onset of an attack of lobar pneumonia the course of the disease is often seemingly much modified. The temperature comes down within twenty-four or thirty-six hours and the patient recovers promptly; when given later, as would be expected, the effect is less pronounced. It is very difficult to draw conclusions of the value of any remedy in lobar pneumonia. In a series of cases at the Cook County Hospital last winter, 50 treated and 50 alternate untreated cases, used as a control, the mortality of the former was 32 per cent., while in the latter it was 50 per cent.

# SYMPTOMATOLOGY.

Atypical Onset. G. Webster<sup>2</sup> calls attention to cases of pneumonia with atypical onset. At least three primary types are recognizable. These are the so-called cerebral pneumonias of infancy and early childhood, when evident meningeal symptoms readily obscure a small and easily overlooked consolidation, usually in either apex; the abdominal type, where the early symptoms may simulate a sharp attack of appendicitis, or even intestinal obstruction, also somewhat more frequent in childhood; and central pneumonia, due to consolidation that is so overlaid with healthy lung tissue as completely to mask the physical signs. Small patches of broncho-pneumonia may give a precisely similar picture, and render differentiation from central pneumonia of the lobar type extremely difficult. A fourth fairly well defined type may be appropriately called "fulminating pneumonia," a title thoroughly warranted by the exceedingly rapid progress to a fatal issue before the development of definite physical signs.

In reviewing the varied and irregular symptoms it is to be noticed that practically the only ones that show with any constancy are the coincident and corresponding rise in the temperature, pulse and respirations. Cough was noticed in two of the cases, the initial chill was altogether absent, pain in the chest was recorded but once, expectoration occurred but twice and then rather late in the disease. The high leukocyte count with relative increase in the polynuclear elements was found in all cases where a blood-count was made and is dependable as a confirmatory sign. But in the confusion arising from so many and so varied symptoms referable to such widely diverse portions of the physical economy it is the suggestion afforded by the rapid respirations,



<sup>(2)</sup> Long Island Med, Jour., September, 1912.

rapid pulse and high temperature that points to the true nature of the obscure condition.

Blood-Pressure. F. F. Gundrum and E. E. Johnson<sup>8</sup> report as follows on a series of 30 consecutive pneumonia cases: All blood-pressure readings were made with an ordinary mercury manometer of the Riva-Rocci type or with a spring manometer which was frequently compared with the mercury column. The blood-pressure and the pulse, taken simultaneously, were recorded daily or oftener if any marked change in the patient's clinical. condition was noted. Of the 30 cases, 26 were lobar in type, 4 broncho-pneumonic. The patients were all adult males from eighteen to sixty years of age. Twenty were alcoholics: 10 denied alcoholic history. The termination in 10 cases was by crisis; in 11 by lysis, and in 9 by The mortality (30 per cent.) is high but not remarkable for a public institution where all of the patients are of the "'less fortunate."

The authors found very great variations in bloodpressure on admission (65 to 122) and of pulse as well (68 to 148). The B-P (Gibson) quotient on admission was one or more than one in eighteen cases and less than one in twelve. Of the eighteen cases showing a quotient of one or more than one on admission, seventeen (94 per cent.) recovered and one (6 per cent.) died. Of the twelve patients whose quotient was less than one, three (25 per cent.) recovered and nine (75 per cent.) died. The findings on the day after admission were much more suggestive. Twenty-one patients showed a quotient of one or higher and nine lower than one, which figures correspond exactly with the death-rate. The correspondence is not so exact, however, as these figures would indicate, for of the twenty-one who had one or plus one fraction on the second day, twenty (96 per cent.) recovered and one (4 per cent.) died. Several patients whose quotients began to drop down were apparently greatly helped by increase or change in medication.

The authors used moderate doses of strychnine by mouth as long as the quotient could be maintained at one

<sup>(3)</sup> Cal. State Jour. Med., May 10, 1912.

or more. If more stimulation was required they added caffeine in 4-grain doses, especially if the heart muscle seemed to be inefficient. The majority of the favorable cases received no other drug. The unfavorable cases were given, in addition, adrenalin hypodermatically when the low pressure was apparently due to peripheral dilation, and digitalin and camphor when cardiac weakness developed. Gundrum and Johnson have placed most reliance on the strychnine and caffeine with occasional doses of adrenalin for times of special danger, possibly because they used this combination first and on favorable cases.

#### Prognosis.

It is held by many authorities that primary uncomplicated pneumonia is a self-limited disease, tending to end in recovery; others have stated that in such cases the mortality should be nil. But for pneumonia complicating other pre-existing diseases, no such prognosis is given. M. Girsdansky<sup>4</sup> believes, however, that even in the latter cases, when fatalities result, these are due not to the pneumonia, which, when properly treated, should always end in recovery, but solely to the underlying conditions.

For example, cases treated for pneumonia complicating cirrhosis of the liver or kidney, Hodgkin's disease, hemiplegia, grave myocarditis, diabetes, carcinoma, advanced senile arteriosclerosis, or extensive pulmonary tuberculosis, when resulting in death, the fatal issue, it seems, was always due, not to the pneumonia, but to the pre-existing conditions. But when pneumonia occurred in the course of an otherwise non-fatal, acute or chronic malady, the pneumonia in itself did not render the prognosis unfavorable and such cases always terminated in recovery. The author reports nine cases which illustrate this point

TREATMENT.

General Measures. H. Babcock<sup>5</sup> advises hygienic care of the room, disinfection of excreta, mainly a liquid

<sup>(4)</sup> N. Y. Med. Jour., June 22, 1912.(5) Ill. Med. Jour., April, 1912.

diet, with the addition of hydrochloric acid, which is usually deficient, and as much liquid as the patient can tolerate. Much medication is not desirable for several reasons, and yet it may be well in some cases to stimulate the excretory organs by simple diuretics and diaphoretics such as bitartrate or citrate of potassium and when blood-pressure is high the sweet spirit of niter. A cathartic daily is advisable and a saline aperient water is best, provided it does not occasion too much flatulence.

Nitroglycerin or other nitrite preparations should never be ordered as a routine practice. The effect of pneumococcus poisoning on blood-pressure seems to vary in different cases. Consequently the sphygmomanometer should be used daily if possible, and the use of vasodilators and heart tonics governed by the readings of the Should cyanosis become unusually pronounced and according to the experiments of Romberg and Paesler indicate threatening capillary paresis from the toxic effect of the poison on the vasomotor center in the cord, then vasodilators are distinctly contra-indicated and adrenalin or cardiac stimulants, as digitalis, are to be used and used freely. This indication is especially urgent if Gibson's danger sign is present, namely, a pulse-rate whose figures are higher than those of the blood-pressure. Death may not supervene in all such instances, but this condition calls for prompt and vigorous treatment.

Babcock advises the application of cold or, if it suits the patient's feelings better, of heat to the chest as a sedative for the relief of pain. Poultices and pastes like antiphlogistine are to be avoided. If necessary morphine should be given as an analgesic or hypnotic.

Tympanites is another symptom that at times proves a very serious complication. In some instances abdominal distention is caused by fermentation of the food, and may usually be relieved by dietary change or restriction according to the judgment of the medical attendant. Cathartics, enemata and turpentine stupes on the abdomen are well-known measures in this condition. But occasionally meteorism is a manifestation and result of

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toxic paresis of the intestines and is a formidable condition. In some instances it resists all attempts at its relief, but Babcock recommends as soon as this form of tympanites is suspected the use of an enema of asafetida made by rubbing up 75 grains of the drug in 3 ounces of yolk of eggs. This emulsion thrown high up into the colon often acts as a powerful stimulus to contraction of the bowel.

Collapse is not of frequent occurrence in pneumonia, yet is so alarming a condition that one should always be on the lookout for its early detection and should have suitable remedies at hand. Since a deceptive fall in peripheral temperature may usher in the collapse, it should be an invariable rule to have the temperature recorded by rectum, not by mouth or axilla. So soon therefore as coolness of the surface, increasing cyanosis and weakness of the pulse lead one to suspect approaching collapse, prompt and energetic measures should be instituted in the hope of warding it off. We may not be able always to combat it successfully, but its prompt recognition and an intelligent appreciation of indications may aid much by wisely directing the means to be employed.

Stimulation is required and must be used often and vigorously, and to this end nerve and heart stimulants, not vasodilators, are necessary. Babcock urges the use of the asafetida emulsion previously mentioned, the same as for relief of tympanites due to intestinal paresis. This good old-fashioned remedy has fallen largely into disuse, for few seem to appreciate how powerful a stimulant it is to the nerve centers and hence to circulation and respiration. In addition to the injection of the emulsion of asafetida, heat to the surface and a drink of hot coffee, hypodermics of musk and perhaps of camphor are highly serviceable. Babcock warns against strophan-

thin,

Effect of Cold Applications. R. Hesse has endeavored by experimental research to determine the effect of cold applications to the chest on the circulation in the lung, particularly when the lung does not take part in

<sup>(6)</sup> Deutsches Archiv f. klin, Med., May 19, 1912.

respiration. He concludes that in experiments on animals it is possible to lower the temperature of a lung by applications to the skin so that the circulation is plainly affected, and it is true that under the powerful action of cold less blood flows through the vessels than at ordinary temperature. This restriction of the circulation may amount to 30 per cent. It seems clear that we are able to reduce the circulation in the diseased parts of the lung by local application of cold; hence the application of an icebag is a very appropriate treatment to check the bleeding from a ruptured pulmonary vessel.

Vaccine. Nathan Raw has long been of the opinion that ordinary methods are insufficient in treating pneu-We require some weapon which will destroy the virulence of the pneumococcic products and produce a rapid immunity in the blood against it. A vaccine to be potent ought to be autogenous—that is, it ought to be prepared from the sputum or blood of the patient himself: but this is a matter of great difficulty, as the disease, being of such an acute and short duration, has either subsided or terminated fatally before the vaccine can be got ready, and it might be borne in mind that to be of real value the vaccine must be injected early in the illness; in fact, if it can be used on the first or second day it acts at times almost miraculously. If we have to wait until the fourth or fifth or sixth day, when there is a general pneumococcic blood-stream infection. the vaccine is of little value, and seems to exert little or no influence on the course of the attack.

We are thus compelled to use a stock vaccine or a homologous vaccine prepared from a pure culture of pneumococci isolated from the blood of a patient suffering from lobar pneumonia. In this we are at a great disadvantage, because the strains of pneumococci vary considerably in their virulence and characteristics, so that we are not certain that we are using a vaccine prepared from the same infection as that with which we are dealing. In spite of this disadvantage, however, the results with a stock vaccine are most valuable.

<sup>(7)</sup> Lancet, March 9, 1912,

Raw has used vaccine in 207 cases, not including mild affections or moribund cases, with a mortality of 34, or 16.4 per cent. Raw believes that the usual dosage recommended by some writers from 10 to 50 millions are too small, and that to get the full effect of the vaccine it is necessary to give it in larger doses and at the earliest possible moment after the onset of pneumonia. He usually commences with an initial dose of 50 millions, followed in 24 hours, if necessary, by another injection of 100 millions, and in some cases he has given 150 millions. with apparently excellent result. He considers the question of dosage by far the most important of all, and as the result of a large experience is convinced that the vaccine itself is harmless, and has never noticed anything but a good effect from its use. .There can be no question that in a certain proportion of cases it appears to have no effect, and does not seem to influence the progress of the disease one way or another. On the other hand, in a great many cases an injection of a large dose is followed by a feeling of comfort and relief, associated with a rapid fall in the temperature and slight improvement of perspiration.

Raw is convinced that we have in pneumococcus vaccine a valuable aid in the treatment of pneumonia, and, although not a specific remedy, it ought always to be used in those cases of a virulent type which threaten

the life of the patient.

F. Charteris<sup>s</sup> reports the treatment of pneumonia by a polyvalent stock pneumococcic vaccine with the following conclusions:

1. The administration of a stock pneumococcic vaccine had no marked effect upon the subsequent course of

the disease.

2. The mortality in the vaccine series (21 per cent.) was slightly higher than in the control series (20 per cent.).

3. The early administration of vaccine did not abort the disease, nor prevent complications.

4. Complications were relatively frequent in the vac-

<sup>(8)</sup> Glasgow Med. Jour., January, 1912.

cine series, viz., one instance of meningitis, two of

empyema and one of hyperpyrexia.

Autolyzed Pneumococci. E. C. Rosenow presents the results of immunization experiments in animals and the results of the treatment of lobar pneumonia in man with various products obtainable from pneumococci. When highly virulent pneumococci are allowed to autolyze in sodium chlorid solution there appears at a certain period a highly toxic substance. This, when injected intravenously in guinea-pigs, rabbits and dogs, produces symptoms characteristic of anaphylaxis in these species. and when injected subcutaneously in man produces a moderate increase in opsonins after a short negative phase, rather marked local reaction, leukocytosis and some fever. These extracts call forth reactions in man similar to those caused by the heat-killed bacteria. The pneumococci after extraction or autolysis lose the ability to retain the Gram stain, show varying degrees of disintegration, and when injected into animals and man exert little or no toxic action, but induce a prompt rise in the opsonic power of the serum without a preceding negative phase. By injecting large enough doses of a combination of the toxic material and the autolyzed pneumococci Rosenow has been able to produce a continuous negative phase.

The highly toxic substance has been found to be soluble in ether. The ether soluble material produces symptoms in guinea-pigs exactly similar to those produced by the autolysate, but fails to immunize the animal treated. The protective power is greater in the antigens from

which the toxic substance has been removed.

For the treatment of pneumonia so far chiefly the autolyzed pneumococci have been used. A study by the statistical method during the past two years at the Cook County Hospital has shown a definite reduction in the mortality of the 130 treated cases. Recently the effect of the non-toxic autolysate has also been tested. The seemingly beneficial effects have been very striking.

Application of Salicylic Acid. Madame L. G. Boutchinskaia-Yourchevskaia<sup>1</sup> has obtained excellent results

<sup>(9)</sup> Jour. Amer. Med. Assoc., Sept. 9, 1912.

in pneumonia, particularly in cases in which the pneumonia followed or complicated la grippe. Having prepared a 10-per-cent. solution of salicylic acid in 90-per-cent. alcohol with the addition of 10 per cent. of castor oil, she soaked a compress in the mixture which she applied over the entire back up to the middle of the shoulder-blade, taking care to cover it with gummed taffeta and to fasten it with a bandage. As soon as the compress became dry it was moistened again with the same liquid. In the evening of the same day the cough became less frequent, the temperature fell and the pulse and respiration became less rapid. At the end of twenty-four hours all the objective signs in the lung disap-

peared.

Heart Failure. According to G. R. Butler<sup>2</sup> the diagnosis of a dilated and failing right heart can often be made by inspection. The face is congested and purplish, the jugulars are distended, and the smaller veins swollen with blood. The dyspnea is of an active type and very severe, the patient laboring for breath, both the ordinary and extraordinary muscles of respiration being in full play. On examination one finds the physical signs of a dilated right ventricle, the percussion dulness extending to the right of the sternum at the cardiohepatic angle. The closure sound of the pulmonary valve is at first accentuated, later growing weak. is enlarged, and progressively enlarges. Edema of the lungs is frequently present. The drug treatment of this condition requires the use of digalen hypodermically in full doses, 1 to 3 syringefuls; camphor, 1 or 2 syringefuls of a 20-per-cent, solution in olive oil; caffeine, one of the double salts, 2 to 4 gr. hypodermically; or, not to be overlooked, Boehringer's strophanthine, ½ to 1 ampoule. All these should be given intramuscularly. Absorption from the numerous muscle veins is substantially as prompt as if the injection were intravenous. It is in such cases as these that venesection has given some brilliant results, and a recourse to blood-letting

Sem. Méd., Sept. 11, 1912.
 Long Island Med. Jour., August, 1912.

should always be seriously considered if the conditions

appear to warrant it.

In later stages the blood-pressure falls, the heart begins to contract at an increased rate, and as the case progresses the pulse becomes arrhythmic, small and finally so thready and rapid that it is difficult to count. Beginning with, or soon following the increased pulserate, tympanites appears and increases, until the abdomen is distended and drum-like. There is a marked pallor of the face, with the general signs of collapse. The patient is delirious, often restless; ultimately stupor and coma supervene; the sounds of the heart become almost inaudible, the prostration is extreme and the end arrives.

By way of prevention the pulse-rate, and especially the blood-pressure, should be watched most carefully. If the pulse-rate equals or exceeds the blood-pressure, in mm., caffeine (2 to 5 gr.) should be given hypodermically every 4 to 6 hours. Indeed, it is a good plan, in all cases which from the onset are obviously serious, to give caffeine as a routine measure from the beginning. If the evidences of vasomotor failure appear, it is important to give in addition to the caffeine, adrenalin, 15 minims every 2 to 4 hours, intramuscularly. This substance has, apparently, a special action in tightening up the vessels of the splanchnic area. Hypodermoclysis, or venous transfusion, of normal salt solution is often a most useful measure, and, if used, the adrenalin may be added to the salt solution. Camphor, hypodermically, is another remedy always to be used. A similar statement applies also to the placing of a couple of icebags upon the distended abdomen. Whether by stimulating a splanchnic reflex (Forchheimer) or otherwise, the effect is often to slow the pulse and lessen the tympanites.

# TYPHUS FEVER.

Etiology. A J. F. Anderson and J. Goldberger<sup>2</sup> describe the recent advances in our knowledge of typhus fever. In July, 1909, Nicolle reported the first successful inoculation in an ape (anthropoid). A few months

<sup>(3)</sup> Jour. Amer. Med. Assoc., Aug. 17, 1912.

later by successfully inoculating the Rhesus and the Capuchin monkey, and showing that these were thereafter immune, Anderson and Goldberger not only confirmed this report but also proved that the fever induced

in the monkey was typhus.

A successful inoculation, whether by intravenous, intraperitoneal or subcutaneous injection, manifests itself by a fever which develops more or less abruptly after a quiescent period of variable duration, and terminates almost as abruptly as it begins. The incubation period has been found to vary between five and twenty-four days; as a rule, however, the fever begins between six and twelve days after the inoculation. As in man, the temperature of the monkey rises fairly rapidly, at times very abruptly, commonly reaching its fastigium in thirty-six to forty-eight or seventy-two hours. It then continues at, or near, the maximum for a variable period of one or two to five or more days, after which it declines.

The defervescence, like the onset, is much like that in man; it is usually gradual, but frequently it is quite

rapid, or even critical.

A monkey that has presented a reaction will be found refractory to a subsequent inoculation and therefore such a reaction is ordinarily a sufficient basis for a diagnosis of typhus. When the fever is so slight as to be doubtful or its course atypical, a definite interpretation cannot be made without the immunity test. Should the test in such instances show that resistance had not been conferred, a diagnosis of typhus is not permissible.

The experimental work of Anderson and Goldberger, of Ricketts and Wilder, of Gaviño and Girard, but more particularly that of Nicolle and Conseil, has developed a solid basis for the conclusion that the virus of typhus is present in the blood at least throughout the febrile

period.

Anderson and Goldberger conclude that satisfactory evidence has not yet been adduced that the blood of the monkey infected with typhus is virulent in the prefebrile stage, but that the blood of the monkey may still be virulent twenty-four to thirty-two hours after the return of the temperature to normal. The virus appears to

adhere closely to the blood-cells. There is no evidence that the virus as it exists in the blood is capable of pass-

ing through a Berkefeld filter.

The virus in the blood is not very highly resistant. It was found that drying for twenty-four hours and heating at 55° C. (131° F.) for five minutes deprives it of infectivity; it may resist freezing, however, for at least eight days.

Gaviño and Girard report that the infectivity of the blood is lost after an hour's contact with phenol in 0.5 per cent. solution, but that it is retained after an hour's contact with saponin in a solution of like strength. They also found that a mixture of 6 c.c. of virulent defibrinated blood and 2 c.c. of ox-bile was infective after an hour's contact at room temperature. These authors point out that the resistance of the exanthematic virus to bile and to saponin, without permitting definite conclusions, is in favor of the bacterial nature of the virus.

It may be considered as established that typhus fever is transmissible by the bite of the body-louse. Nicolle and Conseil believe that the infectivity of the body-louse is limited to the period between the fifth and the seventh day after the infecting feed. They base this opinion on the result of a single experiment. Wilder reports an experiment that seems to indicate that the louse is not infective until the fifth or sixth day after its last contact with the infecting host, but he very correctly points out that it is not justifiable to conclude from a single negative experiment on a single animal, as Nicolle does, that the louse is not infective after the seventh day.

There is highly suggestive, but not entirely conclusive, evidence that the disease is also transmissible by the head-louse. The flea and the bedbug do not seem to play

a part in this transmission.

Clinical Cases. Four cases of typhus fever of the form of *Brill's disease* occurring in one family are reported by M. Nicoll, Jr., C. Krumwiede, Jr., J. S. Pratt and J. G. M. Bullowa.<sup>4</sup> The cases varied in

<sup>(4)</sup> Jour. Amer. Med. Assoc., Aug. 17, 1912.

severity, one case exhibiting the characteristics usually seen in the epidemic form, thus forming a connecting link between the endemic cases, such as have formed the so-called Brill's disease and the severer classical type of typhus fever. The blood of the cases was inoculated into monkeys and also into guinea-pigs with success. In some cases the primary inoculation into the guinea-pigs failed, but their blood inoculated into monkeys caused a development of the disease. This, the authors say, is the first time that the inoculability into guinea-pigs of the endemic form has been demonstrated.

One of the most notable recent advances in our knowledge of typhus is the demonstration that this disease. instead of being the exotic plague that it has almost universally been considered, has actually been endemic in this country for many years. Brill, in a series of papers dating from 1898, called attention to a fever prevailing in New York that was generally regarded as an atypical typhoid or paratyphoid, but which he showed could be satisfactorily distinguished from these infections. He pointed out its close clinical resemblance to typhus, from which he differentiated it, however, on certain epidemiologic grounds. Brill's contributions attracted considerable attention and the nature of the disease described by him aroused not a little discussion, opinion being divided as to whether it was an atypical typhoid, paratyphoid, or typhus, on the one hand, or a disease of unknown origin, on the other.

In the fall of 1911 the authors obtained access to a typical case of this fever and, unlike Brill, succeeded in infecting the monkey with it. Following this they tested its relationship to Mexican typhus by a series of cross-immunity tests, and found that monkeys that had recovered from Brill's disease could not be infected with Mexican typhus, and, conversely, that monkeys that they had reason to believe were resistant to Mexican typhus could not be infected with Brill's disease. This reciprocal immunity shows conclusively that the New York (Brill's) disease and Mexican typhus are identical. As the New York disease, or perhaps better, American disease, for it has now been reported not only from New York but also

from Brooklyn, Philadelphia, Washington and Chicago, is undoubtedly of European origin, we have in this demonstration proof of the identity of the European and the Mexican disease.

This demonstration obliges the American sanitarian to recognize the existence of a problem of which he has heretofore been unaware; it also makes it necessary for the clinician to revise the classical conception of typhus, just as he has had to revise his conceptions of small-pox and yellow fever.

# NON-TUBERCULOUS DISEASES OF THE RESPIRATORY ORGANS.

Importance of Diagnosis. G. H. Evans<sup>5</sup> emphasizes the importance of some non-tuberculous lung infections and the danger that slip-shod diagnostic measures may lead to serious diagnostic errors. Certain peculiar signs sometimes found in people with healthy lungs should be more generally known.

Relatively diminished resonance on percussion is usually elicited at the right apex. This has been variously ascribed to muscular development about the right shoulder, the position of the right lobe of the liver mechanically acting as a mute and thus modifying the percussion note and latent disease. None of these suggested causes, however, satisfactorily explains the phenomenon. Auscultatory peculiarities of the right apex are present in many healthy individuals. The breathing takes on more of the bronchial type and vocal resonance is increased. Noted more than half a century ago by Skoda, these phenomena have received general acceptation by all observers. The theory usually advanced in explanation is the difference in size and anatomic position of the right bronchus. Fetterolf's recent study has, however, brought forth an explanation based on demonstrations on the cadaver. He has shown that almost entirely throughout its thoracic course the trachea lies in contact with the right lung, separated only by the parietal pleura and a delicate layer of areolar

<sup>(5)</sup> Amer. Jour. Med. Sciences, April, 1911.

and lymphatic tissue, while on the left side the large blood-vessels, esophagus and areolar and lymphatic tissue are interposed between the lung and trachea. With these anatomic facts in mind, Fetterolf assumes the phenomena present at the right apex to be due to the more direct transmission of vocal vibrations from the trachea through the tissues of the superior mediastinum to the right lung, rather than through the bronchial and pulmonary air.

In chronic non-tuberculous affections of the lung the physical signs usually present nothing different from what could be expected in a tuberculous lesion. Oftentimes the disease progresses to destruction of lung tissue and abscess formation, as is seen in advancing tuberculous lesions. Frequently extensive multiple bronchiectatic cavities exist, and the sputum may reach a large quantity, the clinical picture being identical with multiple cavity formation in phthisis. Pneumothorax and empyema are occasional complications. The x-ray examination oftentimes reveals the mottled shadowing such as is made by tubercles or the dense shading of extensive tuberculous disease.

It is in such conditions that important diagnostic information can be obtained from careful interpretation of tuberculin tests, based on the reactive capacity of the individual with an active tuberculous lesion to minimum quantities of tuberculin. Recent work with the intracutaneous tuberculin test has convinced the writer that we have in this test a valuable method of applying tuberculin in such minute quantities as to differentiate active from latent tuberculous lesions in a large percentage of suspected cases. By this method as small an amount as 1-100 mg. is injected into the cuticle, care being taken not to penetrate the entire thickness of this membrane. No general reaction follows this procedure as follows the older and less delicate subcutaneous injection. It has the advantage over the cutaneous tests in that it admits of exactness of dosage, a condition sine qua non to the scientific application of diagnostic tuberculin tests.

Repeated examinations of the sputum probably form our best means of differential diagnosis, particularly in chronic influenzal infections. The almost constant presence of the influenza bacillus in well-washed specimens, together with a preponderance of the polynuclear cell element in the sputum afford evidence of great diagnostic value. Wolff-Eissner has called attention to the significance of the presence of large numbers of lymphocytes in tuberculous sputum—a very valuable diagnostic fact. The frequency with which tubercle bacilli were subsequently found in sputum in which lymphocytes were present in large numbers, has taught Evans to recognize in the presence of the latter valuable evidence of tuberculous disease.

Among the many interesting conditions incident to the introduction of tropical diseases is that caused by the trematode, *Paragonimus westermanii*, or *Distoma westermanii*, producing the so-called lung-fluke disease. This parasite, well described by Stiles, probably enters man in embryo form with contaminated food or water, passing either directly from the mouth to the bronchi, or through the stomach and thus by the lymphatics to the lung.

The pathology consists of multiple small cystic formations, sometimes situated deeply in the lung tissue but usually superficially or immediately under the pleura. These cysts contain the parasites in varying numbers. Sometimes the septa between cysts may break down, forming a considerable cavity. The lumen of these cysts or cavities communicates directly with the adjacent bronchi, and thus the ova, together with the caseous material and fluid contained in the cysts, are expelled in the sputum.

The symptoms strongly suggest a tuberculous infection. The onset is usually gradual. There are recurrent attacks of hemoptysis. Hoarseness and a chronic cough develop. The sputum is of a yellowish-red, dusty-brown color and contains the ova of the parasite in varying numbers. The ova should always be examined in fresh, unstained specimens. In addition to the eggs, Charcot's crystals, blood, pus and alveolar and bronchial cells are found. The recurrent hemoptysis frequently gives rise to a severe grade of anemia. The temperature is but

slightly, if at all, elevated. Physical signs sometimes simulate those found in tuberculous disease. tion of the thorax, with unilateral or bilateral signs appreciable on percussion are frequently observed. The breath sounds may be diminished, sometimes they are bronchial in quality, and there may be dry or moist râles. The discovery of the ova in the sputum establishes the diagnosis.

While secondary manifestations of syphilis may present lesions in the trachea and bronchi, and be accompanied by other secondary symptoms which make diagnosis comparatively easy, the tertiary lesions present difficulties in the way of correct diagnosis which make recognition oftentimes impossible unless the rather laconic admonition of Dieulafoy is faithfully observed, namely, that the true means of arriving at this diagnosis is to think of syphilis. The above named investigator has divided lung syphilis into six distinct types, which division presents such an excellent classification that it is quoted verbatim: (1) Pulmonary syphiloma, with acute febrile course, simulating acute tuberculosis or tuberculous broncho-pneumonia; (2) pulmonary syphiloma of slow course, simulating ordinary chronic tuberculosis and phthisis in the stage of cavity; (3) broncho-pulmonary syphiloma, with fibrosis or sclerogummatous lesions, simulating chronic pneumonia and cirrhosis of the lung, with or without bronchial dilatation, pleurisy, and tracheo-bronchial adenopathy; (4) syphilitic gangrene of the lung; (5) syphilitic pneumopathy, complicated by pulmonary tuberculosis; (6) hereditary pulmonary syphilis. With this rather elaborate but practical classification, it will at once be seen that syphilis may present clinical picture that can fit almost any tuberculous lung condition.

While both tubercles and gummas may undergo necrosis and caseation, softening and cavity formation is the rule in tubercle, the exception in gumma. Expectoration, therefore, will be scant, unless destruction has progressed as a result of bronchial stenosis, when, of course, the profuse, purulent, fetid sputum of bronchiectasis may be met with. With extensive destructive lesions the general symptoms do not differ materially from those of advanced tuberculous disease.

Tuberculin tests probably do not offer as great aid in differential diagnosis here as in other non-tuberculous lung affections. Constantini found the intracutaneous tuberculin test positive in all but 3 out of 47 syphilities so tested. Wassermann reactions were also positive in all these cases. He does not believe that local tuberculin reactions can be utilized for the differentiation of syphilis and tuberculosis.

Repeated examinations of the sputum together with careful sifting of the history and thorough search for evidence of syphilis elsewhere in the body, rather than the result of the physical examination of the chest, must remain our most useful means of recognition. Dieulafoy probably did not go beyond the confines of conservatism when he said, "In a suspected case of pulmonary tuberculosis let us always think of the possibility of syphilis; in dealing with a patient considered as a case of incurable phthisis, let us still think of syphilis, and if repeated examinations of the sputum show the absence of Koch's bacillus, let us have immediate recourse to specific treatment."

Actinomycosis has been generally recognized as a disease in the human being. When we realize that one English observer has seen in his practice five cases in a little more than a year, it must be acknowledged that it is more common than is generally supposed. Its lesions produce a symptom-complex easily confused with that caused by tuberculous disease. Weakness, gradual loss of strength, anemia and cough, with or without expectoration, accompany the gradual onset of the disease. Loss in weight and appetite with some fever follow. Localized dulness with weakened breathing over the dull areas may suggest tuberculous consolidation or empyema. Later, signs of cavity formation occur. The sputum, if carefully examined at this time, will probably contain the yellow granules characteristic of the ray fungus. Unfortunately in the search for tubercle bacilli, these other bodies are too frequently overlooked.

Even in a later stage, when the chest wall becomes involved, followed by softening and destruction of these structures, the condition is likely to be mistaken for empyema or a carious rib, when careful examination of the discharge would at once reveal the true nature of the lesion.

Primary malignant disease of the lung is a rare condition, but metastases into the lung from a primary sarcomatous or carcinomatous lesion elsewhere, may frequently occur. Thus cancer of the breast is frequently the cause of a subsequent metastasis in the lung. Less frequently, cancer of the lung is the result of the disease in the stomach, intestines or other abdominal organ, spreading either by means of venous emboli through the portal vein, the vena cava, and thus through the right heart to the lung, or by means of the lymphatics. In suspicious lung lesions, evidence of malignant growth elsewhere should carefully be sought and careful consideration made of the significance of previous operative procedures.

# ASTHMA.

Etiology. A. G. Apostolides bases his views of the etiology and pathogenesis of bronchial asthma on the conception that essential bronchial asthma is a functional neurosis; that is, a condition of which as yet no organic basis has been discovered, characterized by sudden paroxysmal attacks of great dyspnea, with a peculiar exudation of mucin and with distention of the lungs. The attacks may last a few hours or days, or may be protracted for a week. Under the heading of essential asthma we must therefore include those clinical conditions in which the respiratory organs are normal and the attacks are produced exclusively by some perversion of the nervous system, in which finally no objection can be formulated from an anatomic point of view.

The mechanism of the intense dyspnea which characterizes the asthmatic paroxysms may be considered as definitely settled. It is the consequence of a sudden narrowing of the smallest bronchial lumen. So sudden

<sup>(6)</sup> Med. Record, Sept. 21, 1912.

is its onset and so intense may the dyspnea shortly become that even prima facie the idea of spasm seems alone adequate to account for it. The view formerly held almost universally maintained that the asthmatic dyspnea was due to a tetanic contraction of the inspiratory muscles and diaphragm as well as to a spasmodic contraction of the bronchial muscles of the lungs. Apostolides believes that swelling of the mucosa is associated with the bronchial spasm.

The author believes that bronchial asthma is a neurosis, like hysteria and epilepsy, of the higher cortical center, which, according to Brooker, Martin, Frank and others, presides over the lower centers and by means especially of the bulbar centers directs and controls the respiratory movements. This association action of the more complex centers takes place under appropriate stimuli parting from the brain. The curious cases of sudden asthmatic attacks from fright or fear demonstrate the enormous influence of the cortical centers on the respiration.

He believes that idiopathic bronchial asthma is due to a congenital excitability of the cortical respiratory centers, which excitability itself is due to a toxemia depending on alterations of the internal secretion from the bronchial mucosa. In support of this theory there may be cited the well-known experiments of Weichardt and Besche, among others, who, with injections of different forms of albumin (horse-serum), have been able to demonstrate the fact that essential bronchial asthma in a majority of cases is a manifestation of a local cellular anaphylaxis of the lungs. The treatment of bronchial asthma with serum, and the very instructive observations of Landerer and Schittenhelm that patients had asthmatic attacks whenever they were injected with horse-serum, strengthens the hypothesis of a local cellular anaphylaxis.

Anaphylaxis. A. Gouget<sup>7</sup> reviews the work done to establish the anaphylactic character of asthma, and cites the experiments of various workers which have shown that anaphylaxis can be excited by the inhalation of

<sup>(7)</sup> Presse Méd., July 6, 1911.

powdered horse-serum by guinea-pigs which have been previously sensitized by injections of horse-serum. A similar anaphylactic sensitization has been produced by compelling the animals to breathe a diluted beef-serum for two or three hours a day for a period of ten days. Three weeks after an injection of beef-serum excited

the anaphylactic reaction.

Very positive reactions were obtained by the use of asthmatic fluids. E. Manoiloff injected the serum of four asthmatics in doses of two to three c.c. under the skin or into the peritoneum and also intravenously in a guinea-pig and a rabbit. Forty-eight hours after he prepared a solution of Charcot-Leyden crystals obtained from the expectoration of the patient and injected it intravenously in doses of 1 to 2 c.c., immediately there were observed typical anaphylactic manifestations (fall of temperature, marked dyspnea, paralysis of the hind limbs, voiding of urine and feces), and the animal succumbed as a rule in a few seconds or after some hours with pulmonary emphysema and a marked injection of the abdominal organs. Control animals prepared with the serum of a healthy individual and having received at the end of forty-eight hours the same intravenous injection of a solution of Charcot-Leyden crystals, remained unaffected.

. Manoiloff concludes from these experiments that the presence of Charcot-Leyden crystals in the sputum of asthmatics may be regarded as the exciting cause of the asthma. These crystals are formed at the expense of albumin, and act like a foreign albumin. Asthma is therefore a manifestation of anaphylaxis.

[Charcot-Leyden crystals are formed at the expense of the eosinophile leukocytes, so plentifully found in the

sputa of asthma patients.—B.]

The Relation of the Hypophysis to Asthma. O. Weiss' calls attention to the importance of the ductless gland, especially the hypophysis, in the causation and treatment of bronchial asthma. In his view the deficient secretion of these glands leads to an accumulation of carbonic acid in the blood, as a result of which in susceptible indi-

<sup>(8)</sup> Deutsche med, Wochenschr., Mept. 19, 1912.

viduals the asthmatic attack is initiated. The author has secured the disappearance of these attacks in a considerable number of patients suffering from asthma, partly of a very severe type, by the subcutaneous injection of a sterile aqueous solution of the extract of the adrenal glands in combination with an extract of the infundibulum of the hypophysis. He has found that this is successful in cases in which epinephrin did not secure the desired result. This material is put up in ampoules containing each 1.1 c.c. of the mixture which is known as asthmolysin and which contained 0.0008 of extract of the adrenals and 0.04 gm. of the extract of the hypophysis.

The action was always very satisfactory, and the author has made the injection as many as 3,000 times without having a failure more than 10 times, the attack disappearing completely within 12 to 15 minutes. A repetition of the injection was not necessary. He explains the action by supposing that the secretion lacking is supplied to the blood by the injection. He has found no injurious effects and considers that this method of treatment is superior to the use of such remedies as atropine, morphine, cocaine, etc., or the inhalation of vaporized solutions which, in order to be active, must contain considerable amounts of some poisonous agent.

Asthma and Tuberculosis. H. Z. Giffin<sup>9</sup> found on investigation the coexistence of asthma and tuberculosis in 3 out of 82 cases, or 3.6 per cent. In the diagnosis of asthma it is essential: (1) To examine the sputum carefully and without fail; (2) to avail one's self of the aid of the Röntgen rays, especially if early tuberculosis, on the one hand, or fibroid phthisis, on the other, be suspected, for in these the sputum may be negative; (3) to appreciate that the examination of an asthmatic in reality imposes upon the physician the duty of carefully excluding tuberculosis.

Treatment. In the treatment of bronchial asthma I. I. Lemann<sup>1</sup> finds morphine most efficient in relieving the paroxysms, but the danger of forming a habit should

 <sup>(9)</sup> Amer. Jour. Med. Sciences, December, 1911.
 (1) Amer. Jour. Med. Sciences, December, 1911.

assign it the position of a remedy of last resort. Next in importance is epinephrin, on the action of which Lemann has made the following observations: 1. The blood-pressure is not usually high in paroxysms of asthma. 2. It is not increased by adrenalin administered hypodermically in such paroxysms, but tends rather to be lowered. 3. Adrenalin hypodermically frequently relieves the paroxysms, probably by relaxing the bronchial spasm. This relief is wonderfully rapid. In many cases it is also lasting and the patients have a rest for longer periods than after being relieved by other means.

The sheet anchor in the treatment of bronchial asthma is iodin, usually in the form of potassium iodid. practically unanimous testimony of patients is that under its administration the paroxysms grow much less frequent and of less severity. It is not necessary to give large doses of the drug; therefore it is usually possible to avoid any disturbance of the stomach. A prolonged course for several months of 10 to 15 grains of potassium iodid, three times daily, should first be given, and thereafter these doses should be given for periods of ten days, alternating with ten days of rest. Another favorite prescription is to direct that the iodid be taken for the first ten days in every month. With either of these methods it is possible to keep up a sufficient saturation with iodin to bring about excellent therapeutic effects without causing any of the undesirable by-effects of iodism. For this reason the author's experience with the substitutes for potassium iodid, such as sajodin and the like, is extremely limited in the treatment of this disease.

Heroin. A. Fraenkel<sup>2</sup> highly recommends the use of hypodermics of heroin hydrochlorid in cardiac asthma instead of morphine, as it maintains its effect for a longer time, and given in the doses recommended (0.005 to 0.01 gm.) produces no ill effects. Of course, if undesirable symptoms occur, the remedy should be suspended. The author gives an earnest warning against going higher than 0.015 gm. (gr. ½).

<sup>(2)</sup> Therap. Monat., January, 1912.

# PULMONARY EDEMA.

Blood-Pressure. L. A. Amblard<sup>8</sup> gives the results of blood-pressure measurements made in cases of pulmonary edema. As a rule, edema of the lungs occurs in patients with such cardiac affections or renal disease as are accompanied by a continuous high pressure. pressure prevails and increases somewhat immediately before the attack. Just before the attack the minimal pressure is elevated and the maximum pressure is also very high. Such figures as 280, 270 and 240 mm. of mercury are recorded. During the attack a sudden change occurs in the condition of the circulation. minimal pressure falls slightly, but a marked fall takes place in the maximum pressure so that the difference between the maximum and minimum pulse-pressure is markedly reduced. During the attack at the height of the edema bleeding, which is of great service in some cases, has little or no effect on the pressure. After the attack, if the patient does not die, the maximum pressure gradually rises to the normal, but in some cases a new attack may occur with a repetition of the phenomena which have been described.

The most acceptable explanation of these changes seems to be, that from some cause or other a temporary failure of the left ventricle causes a fall of the pressure in the general arterial system, but at the same time occasions a damming back of the blood in the capillaries of the lungs, so that the pressure in the pulmonary vessels is greatly increased and rupture or ozzing of the blood or serum into the parenchyma of the lungs and into the air vesicles occurs. This rupture or exudation may be accelerated by the lesions produced by toxins circulating in the blood. It has been shown experimentally that epinephrin will cause degeneration of the intima of the arteries, inflammation of the alveoli and may lead to edema of the lung if the dose is sufficiently large.

The author states that when a high tension is found preventive treatment in the form of a milk diet should be instituted. Salt should be forbidden and a mineral-

<sup>(3)</sup> Presse Méd., Aug. 12, 1911.)

water treatment, well supervised, should be introduced. After the attacks cardiac tonics are appropriate. During the attack bleeding seems to be the best remedy.

# DISEASES OF THE PLEURÆ.

Malignant Tumor of the Pleura. L. Huismans' reports two tumors of the pleura which were clinically primary and ran a malignant course. He concludes as follows: The necropsy showed that the first case was really secondary to a carcinoma of the stomach, which pursued a latent course. The second must be regarded as a primary tumor, as it sprang from the many-layered epithelium of the pleura. From the extensive distribution of the lesions in the pleura without involvement of the lung it may be concluded that the lymphatic system of the lungs and the pleura are quite independent. The malignant tumors of the lung compress the bronchi by infection of the glands at the hilus. Pleural carcinomata show metastases into the axillary and supraclavicular glands. The carcinomata of the pleura spread first by continuity of tissue and later by contiguity. A confusion between a tumor of the pleura and thickening following inflammation thus becomes possible.

Position of the Effusion in Pleurisy. Wm. Engelbach and R. D. Carman<sup>5</sup> have made a study of sero-fibrinous pleuritis with the aid of the x-ray and con-

clude as follows:

1. The location of the fluid in serofibrinous pleurisy is variable. In a great majority of the cases it is more or less in the vertical position in the upright chest. The location is probably dependent upon the most constant position assumed by the patient during the acute stage of the disease. Adhesions forming at this time encapsulate the effusion, fixing it permanently in this portion of the chest.

2. The encapsulation of serofibrinous effusion in different positions of the pleura will explain the discrepancy of the physical findings with relation to the dis-

<sup>(4)</sup> Deutsche med. Wochenschr., July 4, 1912.
(5) Amer. Jour. Med. Sciences, December, 1911.

placement of organs, Grocco's sign, obliteration of Traube's space, mobility with change of position of the

chest, and other confusing physical findings.

Coin Sign. B. M. Slatowerchownikow concludes an investigation of the signe du sou or coin percussion, as follows: Our investigations have led us to the conclusion that the symptom known as the signe du sou is a very valuable sign for the diagnosis of an exudate in the pleural cavity and for the determination of the limits of the same. In exactness it is superior to percussion and vocal fremitus.

So far as the influence of the character of the exudate on this sign is concerned, it is given both with serous and purulent fluids, as has been shown by L. J. Jastrschembski.

Special value must be accorded to this sign in certain cases in which it is impossible to elicit vocal fremitus, because of unconsciousness, weakness or loss of voice, and also when aspiration is impossible. The findings by means of this sign are equally valuable with those of diagnostic puncture in the observation of the author.

<sup>(6)</sup> Deutsche med. Wochenschr., July 4, 1912.

# DISEASES OF THE CIRCULATORY ORGANS

# DISEASES OF THE HEART.

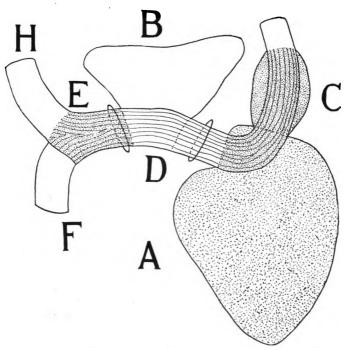
GENERAL CONSIDERATIONS.

## ANATOMY.

Origin of the Bundle of His. T. E. Satterthwaite<sup>7</sup> summarizes the steps which led to the discovery of the bundle of His. As has long been known, the heart at an early period of embryonic life is a tube, at one end of which is the sinus venosus, where the venous trunks unite. From this tube pouches develop to become, on the one hand, an auricle and, on the other, a ventricle, while the original tube still connects them. Eventually this primitive tube is converted into the His or auriculoventricular bundle. These parts may be recognized in some of the lower animals, although not in the human The remains of the sinus, however, have been discovered by Keith and Flack, and they are located at the mouths of the venæ cavæ. Tawara's node is situated in the wall of the right ventricle near the mouth of the coronary sinus. The auriculo-ventricular bundle passes to the auriculo-ventricular septum, from which its branches extend into the walls of the ventricles. bundle curves over to the membranous septum, entering and following the moderator band until it reaches the base of the large group of papillary muscles. (Plate III.)

Proceeding from Tawara's node the bundle runs at first almost horizontally forward and to the left, sheathed in a fibrous canal. It next pursues its course directly to the right of the central fibrous body of the heart as far as to the membranous part of the septum of

<sup>(7)</sup> Interstate Med. Jour., January, 1912.



in In

1h

e

e ) t (D) is the primitive mammalian tube, indicated by longitudinal striations, extending from the sinus venosus (E), where the upper vena cava (H) and the lower vena cava (F) join, through the bulbus cordis (C) to the aorta. (B) is the primitive auricle and (D) the auricular portion of the primitive tube, or auricular canal. The bulbus cordis is eventually included in the human right ventricle. (Schematic representation after Keith.)—Satterthwaite. (Page 144.)

#### PLATE IV.



Human heart showing the origin, course and distribution of the auriculo-ventricular (His) system. The anterior walls of the right ventricle and right auricle have been removed. The intra-auricular septum, the tricuspid valve, the papillary muscles (G), the moderator band (F), and the interior of the infundibulum (H) are exposed. (A) lies in the right auricular appendix, (B) in the fossa ovalis, (E) is placed beneath the mouth of the coronary sinus. Directly beneath (D) is a fan-shaped bit of muscle; a bristle has been placed beneath it. From this point the auriculo-ventricular bundle and its right branch are traced as they lie on five bristles between (D) and (F).—Satterthwaite. (Page 144.)

the ventricle. At the anterior part of this membrane the bundle divides, entering the left ventricle immediately beneath the center of the aortic valve. Ultimately its branches are continuous with the subendocardial network of Purkinje's fibers, which line most of the interior of both ventricles. The structure of the various divisions of this system varies considerably. At the auriculonodal junction the fibers are those of smooth muscle tissue interspersed with connective tissue, nerve fibers and ganglion cells. In their course the muscle fibers increase in size until they form networks and finally take on the well-known character of Purkinje's fibers. (See Plate IV.)

Nervous Connections. In a treatise on the anatomy and pathology of the heart, A. E. Cohn<sup>8</sup> points out that an investigation of the anatomic facts which underlie the functions of the heart muscle necessitates a subdivision into those which are muscular and those which are nervous, assigning each to its proper domain.

The teaching that nerve fibrils surround and themselves interlace about the muscle fibers of the main body of the ventricular musculature is already old and accepted. Much has been added to our knowledge of the location of the ganglia within the heart, both of man and lower animals. More recently Tawara, Wilson, Engel and others have demonstrated the presence of nerve fibrils in the same sense about the auriculoventricular bundle, and in some species have even shown that ganglion-cells can be found far down in the ventricle in close union with the ventricular branches. anatomic facts are known, but as yet nothing has been added to our knowledge of their function, and, more especially, no clinical abnormality has been correlated with a defect or lesion involving them. Furthermore, although a considerable literature has been accumulated in relation to the extrinsic nerves and central ganglia, both anatomic and physiologic, it must be confessed that, in spite of the many facts collected in regard to the action of the vagi, the accelerators, and the depressor nerves, clinical knowledge of them is very deficient, and

<sup>(8)</sup> Amer. Jour. Med. Sciences, November, 1911.

in many respects absent. Finally, it may be pointed out that there exists practically no investigation which relates the paths and distribution of the extrinsic with the

system of intrinsic cardiac nerves.

The most that can be said is that certain manipulations of the extrinsic nerves produce certain effects, and that the calling forth of these effects are very limited in number and are not constant phenomena. Here then is a large though difficult field for future investigation, and it would seem that, until much more knowledge along these lines is at hand, a myogenic and a neurogenic doctrine may be useful as points of view from which to investigate, but these doctrines should certainly not furnish a basis for the erection of hostile camps, from both of which polemics constantly keep pouring forth.

The fibers of the auriculo-ventricular bundle are not properly embryonic. They are cardiac fibers which have specialized in a peculiar direction; their fibrillar struc-

ture is especially distinct.

Hering claims that the node of Tawara delays conduction. Aside from the node and bundle, the demonstration of nerve trunks, nerve fibers and nerve ganglia in the conduction system, and a demonstration of the constant union of the auriculo-ventricular node with the auricles,—a point that was necessary to complete the knowledge of the anatomic path and to show that normal automatism was a function which need not be ascribed to the auricle any more than to the ventricle,—complete our anatomic knowledge about the auriculo-ventricular conduction system.

The sino-auricular node has communications with the auricular musculature in every direction, but it has no special connection with the auriculo-ventricular bundle. Its site and microscopic anatomy have been confirmed by Koch and other observers. That rhythmicity-stimulus production has its seat in this node, and that it acts under normal conditions as the pacemaker of the heart

was originally claimed for it by Keith.

The pathologic changes in rhythm and conductivity only have received an anatomic explanation. Sixty per cent. of all cases of irregularity of the heart fall under the heading of the so-called pulsus irregularis perpetuus

now explained as auricular fibrillation.

So far isolated lesions involving either the auriculonodal junction or the auriculo-ventricular node itself are not known. When we go on to the main stem, however, a variety of lesions are noted. These may be divided into those which form complete transverse lesions of the bundle, in the same sense that there are complete transverse lesions of the spinal cord, and incomplete transverse lesions. This latter group contains both disseminated lesions and lesions which do not completely divide the bundle.

In the group of complete transverse lesions are enumerated tumors, both benign and malignant, metastases or infiltrations; inflammations, usually syphilitic, among which the calcified gumma plays an important part; and degeneration due to vascular disturbance, either thrombotic, embolic or endarteritic. These complete lesions all cause complete auriculo-ventricular dissociation, and may or may not be associated with the Adams-Stokes

syndrome.

In the second group are those cases in which the lesion does not divide the auriculo-ventricular bundle completely. In these there are found the products of chronic inflammation, firm old connective-tissue infiltration of the main stem, and infiltrations with rather large quantities of fat tissue. A special type consists of the presence in the bundle of large blood sinuses which have materially reduced the diameter of the bundle. It must be confessed that in the group of incomplete transverse lesions, cases are found where the auriculo-ventricular dissociation is complete, and others where it is partial. Whether the amount of injury alone is responsible for the varying degree of block, or whether additional factors related to nerve control, nerve destruction, or nerve tone, are here involved, more especially in the cases of complete dissociation, cannot now be properly appraised.

A third group of cases must be added in which there are marked lesions of the bundle, but in which, clinically, all types of heart block are demonstrated, from lengthened A-C intervals to complete dissociation, changing from one form to another in rather a startling fashion. To account for such cases, it has been supposed that the block has been from time to time increased and then diminished by the presence of inflammatory processes which undergo exacerbations and then subside, and which in their organization tend effectually ultimately to destroy the bundle.

In addition to these three groups is a fourth, in which heart block has existed clinically for years, as in Krumbhaar's case, in which a lesion commensurate with the clinical findings cannot be demonstrated. In fact, it can be shown that the hearts in such cases contain lesions less in amount than are observed in hearts known to present no manifestations of disturbed conductivity during life.

Finally, there are a few cases in a fifth group in which, through inflammation or otherwise, one or other of the ventricular branches of the auriculo-ventricular system have been found cut off from the main stem. These cases

reported by Eppinger, aside from rather vague but certainly distinct clinical manifestations, have been diagnosticated electrically, and are of great clinical interest.

Whether chronic and acute interstitial myocarditis plays a rôle in the production more especially of ventricular extrasystoles is not known. The assumption is held nevertheless and the cases are called cases of cardiosclerosis. It is, however, a fact that there is no definite correlation known as yet between abnormal structure and abnormal function in any of these cases, nor are the limits of structural change in general convertible into the extent of functional deficiency.

In these days, when we are set about by tracings made in a variety of ways, by instruments that detect numerous different physiologic activities, and by the effort to understand the meanings of the tracings once obtained, one must insist, and insist strongly, that all this is but machinery, nothing but a means to an end. It is as aids in understanding the heart in health and disease that this cumbrous apparatus is called into being. The tracings which they yield will be exceedingly barren, unless the effort to interpret them from the standpoint of anat-

omy and of physiology, both normal and abnormal, is constantly made.

## PHYSIOLOGY.

Origin of Heart Beat. B. Kaufman' proposes a new theory concerning the origin of the heart beat. Since all vital phenomena and life activities go hand in hand with the pulsations of the heart, this function, its cause, its normal rhythm and its variations in health and disease have been points of the greatest interest in trying to solve the problem of its origin. The heart is developed independently of the blood and blood-vessels; it contains at first a clear fluid, and begins beating before the bloodvessels from the area vasculosa have joined it. Minot states that all closed vessels in an embryo contains a fluid. At the time when the heart just begins to beat it is a single, median, straight tube containing fluid. The fact that this vessel contains fluid can be taken as showing that the cells of the tube either secrete into the vessel so formed the fluid found within it, or the fluid contained within it comes from the liquefaction of the cells constituting, or entering into the formation of such These cells must possess in its intensest form the characteristics of living protoplasm. viz., excitability and contractibility.

The result is that we have a tube whose confines consist of protoplasm in a state of easy excitation, and which contains a fluid which must exert a greater or lesser pressure on its walls. If Heissler's idea is accepted, this tube is constantly secreting into itself the products of liquefaction of the cells constituting the walls. The pressure, therefore, will be gradually increasing, due to the accumulating of such liquids until at last the pressure exerted is sufficient to act as a minimal stimulus to the protoplasm, to which it responds by a contraction. Since the heart at this time is a single tube, at the site of the first contraction the lumen of the tube would be narrowed, and, acting upon it, the contained incompressible fluid would raise the pressure in the segment nearest to it till the pressure here also was above the point of

<sup>(9)</sup> N. Y. Med. Jour., Oct. 12, 1912.

minimal stimulus for its cells, and a contraction would occur. This would be progressive, therefore, down the heart from segment to segment, and result in a wave of

contraction along the tube.

Therefore, when the pressure within the heart is raised, the contained fluid is forced through the intercellular spaces which Arnold has shown to exist in the adult, and the pressure within the heart gradually lessens, till all the fluid which the contracting vessel can expel has been thus treated. Now that the stimulus to contraction has been withdrawn, the cells hasten to return to their normal shape, for by this means only can their maximum amount of nourishment be obtained, and the processes within the cells carried on at their highest point. The tube then fills with fluid until a new contraction is excited.

[If this theory is needed to explain the beginning of the heart's beat, why is not the same secretion of fluid necessary to explain the continuation of the beat? But it is recognized that the heart does not beat on account of the pressure of the blood, for it will beat when isolated from the body. The theory seems of doubtful validity.—S.]

Effect of Physical Exercise. E. O. Otis¹ gives the result of measurements of blood-pressure following physical exercise in about 350 cases, including men, boys, young women, etc., and formulates his results together with those of other investigators as follows:

One may say that physical exercise in the majority of cases, of whatever nature it may be, excessive, severe and long continued, or more gentle and moderate, causes a rise in the systolic blood-pressure, the maximum occurring sometimes during the effort. As fatigue sets in and advances, the pressure falls to normal or subnormal. "A maximum systolic pressure," says Lowsley, "is reached more rapidly in the case of a fatigued individual, but it is not nearly so extensive." If the exercise ceases at a time when the increased pressure exists, which is indicated by taking it immediately upon stopping exercise, the return toward the normal takes

<sup>(1)</sup> Amer. Jour. Med. Sciences, February, 1912.

place rapidly, generally within a comparatively few minutes. Or, if it ceases after the fall to subnormal has occurred, as in the case of more extensive, fatiguing, and long-continued exertion, then the return *upward* to the normal is slower, depending upon the degree of fatigue and exhaustion. Lowsley considers the subnormal phase following the exercise as an important indication of the effect of the exercise upon the individual. "When," he says, "the subnormal phase returns to normal within sixty minutes, the exercise may be considered as lying well within hygienic limits for that individual; while a return that is delayed beyond 120 minutes may be regarded as exceeding these limits."

We may represent graphically the various phases of the blood-pressure during and after physical exercise by a double curve, starting from the normal (N) for each individual, and rising until the maximum (M) is

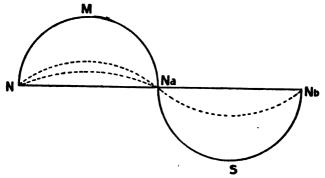


Fig. 1.—Graphic representation of the various phases of the bloodpressure during and after physical exercise.

reached, at a greater or less height; remaining there for a greater or less time, according to the strength of the individual for sustained work, his condition of freshness or fatigue, and his degree of training; then, as fatigue begins and increases, falling and continuing to fall until the normal (Na) and subnormal (S) point is reached; and finally, after cessation of the exercise and rest, a return more or less rapidly, depending on the

break degree of fatigue, to normal again (Nb). (See

Fig. 1.)

The autnor refers to the proposition of Panchon that the blood-pressure be made a criterion of the ability of the laborer to perform the tasks which are imposed on them.

### PATHOLOGY.

Experimental Work. L. Loeb and M. S. Fleisher<sup>2</sup> describe the method employed in the production of hypertrophic and myocarditic changes in the heart of rabbits, briefly, as follows: They injected into the earvein of a rabbit a single small dose of epinephrin (0.2) c.c.) preceded by sparteine sulphate or caffeine-sodium benzoate. They found macroscopic changes in the heart muscle a few days after the injection, which, however, were most marked ten to fourteen days after the injection. Shortly after the injection slight interstitial edema was found in the heart, and somewhat later the muscle fibers showed a slight increase in size. Several days after the injection, the muscle fibers were distinctly increased in size and their nuclei were also larger; the connective tissue between the muscle fibers was increased in quantity.

In the next few days the changes became more pronounced. The separation of the muscle fibers due to edema was now marked. In places they found degenerative changes in the muscle fibers; some of the fibers appeared to have been dissolved, only a thin ring of muscle substance surrounding the nucleus; the striations were now indistinct in the fibers.

About two weeks after the injection the changes had reached their maximum. The connective tissue increase was diffuse. The degenerative changes in the muscle proper had become more extensive. Besides a larger number of the muscle fibers and their nuclei were increased in size, and frequently double nuclei were seen in the muscle cells.

From this period onward the changes became less marked, both macroscopically and microscopically. The

<sup>(2)</sup> Jour. Amer. Med. Assoc., Nov. 4, 1911.

hypertrophy of the muscle fibers and muscle nuclei gradually disappeared; the degenerative changes were no longer apparent. Finally, twenty weeks after the injection, small islands of fibrous tissue which had supplanted the degenerated muscle fibers were the only remaining evidences of the hypertrophy of the heart and myocarditis.

The authors attribute the hypertrophy of the muscle to an absorption of water in consequence of an increased permeability resulting from toxic action and mechanical strain.

In view of the results of the large majority of investigators, it is very probable that epinephrin does not cause a constriction of the coronary vessels, and that, accordingly, it cannot interfere with the nutrition of the cardiac musculature.

A direct toxic action of epinephrin on the heart muscle has to be considered as a possible explanation, especially as it is very probable that the necroses found in the media of the aorta after numerous injections of epinephrin are due to a direct toxic action on the media of the vessel. Especially might such an interpretation appeal to us in cases in which after repeated injections of epinephrin, degenerative changes are found both in the aorta and heart. Here it might be held that a toxic action has been exerted on both organs. Nevertheless, it seems that this explanation is not applicable in the case of their experiments, in which, after one single injection of epinephrin, marked changes were found in the heart muscle. They conclude, then, that mechanical strain with its physico-chemical sequels is responsible for both the cardiac hypertrophy and myocarditic changes in the rabbit's heart.

There exist, however, some differences between the conditions found in the rabbit's heart and in hypertrophy and myocarditis in man. In the former, the parenchymatous degenerative changes in the musclecells are more prominent than in the latter. This difference is, perhaps, due to the acuteness of the change in the heart and to the excessive strain, extending over a brief period only in the rabbit, while in man the

strain is more chronic, extending over a long period, and is usually less at any given time. In the latter we might, therefore, expect the hypertrophic and interstitial changes to prevail. We have, however, seen that also in the case of the rabbit the degenerative parenchymatous changes disappear relatively rapidly, leaving merely some fibrous bands. We may, therefore, assume that in man degenerative parenchymatous changes which perhaps existed at given times—and such changes are occasionally found in cases of hypertrophy—will heal within a brief period of time, leaving behind fibrous nodular bands.

The authors believe that attention ought to be drawn to the similarity existing between the experimental lesions in the rabbit's heart and a large class of lesions found in the human heart, and that a similar pathogenesis may be suggested for both sets of conditions, the cardiac hypertrophy and the myocarditic changes.

Pathology of Rheumatic Carditis. W. Lintz<sup>3</sup> gives the following statement of the pathology of rheumatic carditis: Pathologically we find, as a rule, in all three parts of the cardiac wall certain inflammatory lesions, which have been called "submiliary nodules" (C. Coombs). These nodules consist of (a) a groundwork of homogenous material which gives the staining reactions of fibrin; (b) a more or less defined zone of cellular proliferation, the characteristic cells being large and of a fibroblastic type, with a deeply staining cytoplasm and from one to six nuclei, in which a somewhat loose chromatic skein takes hematoxylin with avidity. They are therefore similar in structure to the larger subcutaneous node, so characteristic of rheumatic infection. The shape of the nodule is dependent to some extent on its surroundings, being globular when lying in a loose bed of connective tissue, but fusiform where it is limited laterally, as it is when it develops in the interstitial tissues of the myocardium. In rheumatic lesions of the heart degenerative and necrotic changes are not intense in degree. Emigration of leukocytes is moderate and diffuse, mononuclear types predominating.

<sup>(3)</sup> Jour. Amer. Med. Assoc., Mar. 2, 1912.

Myocardium.—The nodules are closely related to coronary arterioles. There are more in the wall of the left than that of the right ventricle. Very few, if any, in the right. On the whole, the muscle-cells appear less altered than might be expected, probably owing to the relative coarseness of the staining methods.

Endocardium.—This shows the constant occurrence of nodules in the deeper parts of valves, the presence of a diffuse and mild mononuclear leukocytosis, the ultimate vascularization of the inflamed valve. The endothelium proliferates, the surface cells float off because of the degenerative changes, and the fibrin deposited in this stripped surface—sometimes mingled with leukocytes from the intracardiac blood—becomes permeated with new connective tissue bearing young capillaries.

It is within these *Knötchen* or submiliary nodules that numerous diplococci are readily found and may be easily cultivated. This adequately explains why, except in very virulent forms, we fail to obtain the organism from the blood by means of blood-culture methods.

In the light of the above consideration of the pathology of this disease, Lintz believes that we are warranted in concluding that the micro-organisms of rheumatism are carried to the valves by the coronary blood and not by that flowing through its chambers. In reviewing the literature and the recent text-books on his subject, it is found that even most of those who believe in the infectious nature of rheumatic carditis think the organism is simply deposited on the valve by the intracardiac blood. Dieulafoy tries to explain that the reason why the left heart is selected is that the organism is an aërobe and thrives better in oxygenated blood. Strümpell still believes that the organisms are simply deposited by the blood-stream on the surface of the valves, but deems that an explanation is necessary as to how they stay there and are not swept off, being right in the midst of a swift blood-current—he calls in the phagocytic action of the endothelial cell which seize the bacteria and give them a firmer foothold. But why should the bacteria choose the valves? Do not the same phagocytic endothelia line the auricular and ventricular recesses.

the little hooks and nooks among the chordæ tendineæ and musculi pectinati? Mural endocarditis should be far more frequent than valvular, which of course is not so. But, it will be said, the valves have no blood-vessels. How, then, do they get their nourishment? How would the presence of the Spirochæta pallida in similarly nourished structures, as the cornea is syphilitic keratitis, be explained?

As to why the mitral valve is the one most frequently affected, Lintz does not know. He believes that there will be no explanation forthcoming until we understand better the physiologic chemistry both of bacteria and of the tissues, and their interaction. The same factors that govern the selective action of bacteria in other parts of the body, regarding which we are still in profound

ignorance, most probably enter into play here.

Can we explain why one attack of rheumatic endocarditis predisposes the individual to more and graver attacks? A glance at the pathology of the valve explains it. Rheumatic inflammation of the valve results in its vascularization, and hence during the next attack will admit organisms in larger quantities deep in the valve than it would in a normal non-vascular valve.

The toxin of the *Diplococcus rheumaticus*, unlike that of diphtheria and other bacteria, exerts but slight degenerative power on the heart-muscle. This particular poison exerts its deleterious action mainly by paralyzing the tonicity of the muscle, which loss of function is responsible for the fatal cardiac dilatation. Hence the elaboration of toxins by this organism is by far of greater importance than its production of the local inflammation.

Perhaps one of the earliest objective signs of rheumatic carditis is the mitral murmur. And yet, if we should examine the valve we would find that the local inflammation is but comparatively slight and entirely insufficient to account for early incompetence. The true explanation of this, as first pointed out by Gassage, lies in the fact that it is not the valves but a loss of tone in the mitral sphineter that is responsible for this leakage. The pathologic reason for such loss of tone is the develop-

ment, especially near the mitral ring and near the root of the aorta, of inflammatory nodules. In such nodules, toxins would be elaborated and the lymph of the part would contain these toxins. Hence the muscle fibers of the mitral sphincter would be bathed in toxins, the special action of which is to diminish tonicity, while the rest of the cardiac muscle would be much less severely poisoned, since the toxins must be absorbed in the general circulation in order to reach any fibers that are not in close proximity to the nodules. Thus in any rheumatic myocarditis an early loss of tone in the sphincter of the mitral valve would be expected, with the development of a regurgitant murmur. Nodules tend also to form near the root of the aorta; but the aorta has a fibrous connective tissue and not a muscular sphincter; therefore no change is produced during an attack of rheumatic fever. Thus an apical systolic murmur is the sign of rheumatic myocarditis, and is indeed quite often the only sign of inflammation of the heart apart from pericarditis.

Lintz<sup>4</sup> summarizes his conclusions as follows:

1. Rheumatism is a specific infectious disease caused by the *Diplococcus rheumaticus*.

2. The pathology of rheumatism is absolutely charac-

teristic of that disease and of no other.

3. The valvular lesions are caused by the dissemination of the micro-organisms by means of the coronary circulation, and these organisms are not simply deposited on the valves by the intracardiac blood-stream.

4. The cardiac murmur heard at the apex, even early in the disease, is never functional, but is due to a change in the myocardial mitral sphineter, which has lost its

tonicity and hence dilatation of mitral orifice.

5. General cardiac dilatation, the most serious derangement in the disease, is due to the loss of tonicity of the heart muscle as a result of the selective action of this particular toxin on the myocardium.

6. A derangement of the pulse and temperature ratio

is of diagnostic importance.

<sup>(4)</sup> Jour. Amer. Med. Assoc., Mar. 2, 1912,

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- Rise of temperature is observed to have a relation to the feeling of well-being.
- Simple and malignant endocarditis represent but different degrees of one and the same process.

## ETIOLOGY.

Lactic Acid as Cause of Heart Lesions. W. Kerr<sup>5</sup> calls attention to the toxic effect of lactic acid on the heart, and shows that lactic acid is a cardiovascular poison normally produced within the body. The great bulk of the lactic acid is destroyed in the tissues by various processes. In case the muscles are imperfectly supplied with oxygen, lactic acid tends to increase in the tissues. It may also arise from the absorption of lactic acid from the alimentary canal or from an excessive supply of carbohydrate food.

The summary of these different observations is that, so far as they relate to the heart, the muscles of the whole cardiovascular system are poisoned by a very slight increase in the amount of lactic acid in the tissues; that this excess may be produced by perfectly physiologic processes, such as violent exertion, and when respiration in the same length of time cannot supply an equivalent increase of oxygen for the destruction of the acid, accumulation takes place. Or the excess and accumulation may be due to defective metabolism arising from a variety of causes already mentioned.

These observations show that the myocardial changes found in people who have been subjected to hard muscular exertion, are not necessarily secondary to those found in the coronary circulation, but that both may be due to a common toxin; they indicate where we may look for the cause of the disturbance when treating cases; and, lastly, they give us the opportunity of adopting a line of treatment, both medicinal and dietetic, which promises better results than that now generally followed.

Another matter of interest is the use of the calcium salts in the treatment of myocardial weakness during prolonged or severe pyrexia, such as we find in pneumonia or the continued fevers. Early in 1908. Sir

<sup>(5)</sup> Jour. Amer. Med. Assoc., Nov. 4, 1911.

Lauder Brunton advised the use of calcium chlorid, in doses of from five to ten grains every four hours, for the purpose of maintaining the heart's action when failure was imminent in an elderly woman who was suffering from an influenza pneumonia. He based the advice on his knowledge that calcium chlorid is a constituent of Ringer's solution, which is used for perfusing isolated hearts during physiologic experiments. Many years ago Ringer observed that when the frog's heart was perfused with a sodium chlorid solution in distilled water the heart's action was not sustained so long as when the solution was made with water drawn from the ordinary faucet, and on examination found that the latter contains calcium salts, which, of course, were removed during the process of distillation, and since that time it has been generally recognized that the sodium chlorid solution will stimulate the heart to activity, but that the addition of calcium is absolutely necessary if it be desired to continue the contractions for any length of time.

Kerr has followed Brunton's suggestions in the treatment of pneumonia and also typhoid fever with favorable results. The administration of the calcium was commenced early in the course of the disease and continued until the beginning of convalescence with the hope of maintaining the heart's action rather than of reëstablish-

ing it when failure had commenced.

Cause of Dilatation. L. M. Warfield<sup>6</sup> gives the following account of changes in the heart muscle which cause it to dilate in response to overstrain and to remain dilated. Pathologically there is parenchymatous degeneration due to the infectious fevers, among which rheumatism and diphtheria stand preëminent. A specific form of degeneration due to rheumatism has been described. The heart muscle necessarily, during the period of degeneration, is much weakened and subject to dilatation upon the least strain. Fatty infiltration is not a true disease of the heart muscle, but the fat may be deposited in such large amounts between the muscle-bundles as to produce pressure atrophy and replacement of some of the muscle cells by connective tissue. This

<sup>(6)</sup> Interstate Med. Jour., October, 1911.

may not necessarily weaken the heart. On the contrary, it may be the means of adding strength to a heart which is embarrassed by too much fat. However, fatty degeneration is a true disease of the muscle, characterized by destruction of the individual cells and replacement of the cells by fat droplets. A certain amount of connective tissue also is deposited throughout the heart. A heart with this condition is weak, although it may do its work for a long time, never giving cause for suspicion that it is diseased until some slight strain is placed

upon it.

Fibrous myocarditis is probably the commonest disease of the muscle, the one oftenest responsible for permanent dilatation. This may follow repeated strain as in chronic nephritis, arteriosclerosis, overeating, hard manual labor, etc. It has been shown that the hypertrophy which practically always is found in such hearts is first due to an imbibition of water by the individual cells. The cells also elongate but do not seem to increase in number. With the increase in size of individual fibers there goes hand in hand destruction of other fibers, and connective-tissue deposits take the place of the atrophied and destroyed cells. Some believe that continued strain leads to a replacement of the edema in the muscle by connective tissue. Such changes have been found in the heart of experimental adrenalin myocarditis (Pearce, Fleischer and Loeb). It has been held that the deposition of fibrous tissue was due to anemia caused by contraction of the coronary arteries and consequent failure of the blood-supply. Fleischer and Loeb, in a study of experimental myocarditis produced by the injection of sparteine sulphate and caffeine-sodium benzoate together with adrenalin, believe that the myocarditic changes in the heart are due to excessive contraction of the muscle fibers of the heart and not due to the contraction of the coronary vessels. The lesions are almost invariably and always most advanced near the auriculo-ventricular ring in the left ventricle and in the tips of the papillary muscles where the strain is greatest. They also find that hearts showing such myocarditic

<sup>(7)</sup> Arch. Int. Med., 1909, p. 78; 1910, p. 427,

changes on macroscopic examination were functionally inferior to normal hearts, when placed under conditions in which a surplus of work is required. This only bears out what has long been known clinically and

proved at necropsy.

Finally, the heart may be weakened by actual atrophy of the organ due to decrease in size of the fibers and a degeneration of the cells in which granules of hematoidin are deposited in a fusiform arrangement around the nucleus. Normally there are a few granules at each pole of the nucleus. The heart so atrophied has a muddy brown color, the muscle is flabby, and it is functionally exceedingly weak. The condition is known as brown atrophy.

## DIAGNOSIS.

The Sphygmograph. This instrument was devised by Marey in 1860 but failed to give satisfactory results, according to T. E. Satterthwaite. The causes of failure are: 1. The fact that, to secure a good tracing, the exploratory button or base has to be placed immediately over the radial, so as to press it against the bone. 2. A certain but indeterminate degree of pressure is necessary. 3. The surface of the smoked paper has to be quite smooth, or else the pointer will register improperly. 4. Even with the same instrument used on the same subject the tracings will vary, owing to the fact that it is impossible to adjust the button to precisely the same spot at successive tests. Similar statements, made with even more emphasis, are applicable to the use of the cardiogrammatic machine.

And yet the sphygmograph can so demonstrate the rhythm and the pulse-rate that in the very rare instances where the pulse cannot be counted in the ordinary way, the instrument will furnish the desired information. A pulse of 300 cannot be counted except by a recording instrument. In estimating tension, however, nothing equals the trained finger. The uses of the sphygmograph are therefore few, and seldom has it given any valuable information.

<sup>(8)</sup> Med. Rev. of Reviews.

A sphygmogram taken simultaneously with a phlebogram or cardiogram, in cases of infrequent pulse, will reveal the relation between the operations of the heart, arteries and veins in a way that is a most valuable aid

in diagnosticating the existing condition.

The Clinical Use of the Sphugmograph. R. Van Santvoord describes as follows the clinical use of the sphygmograph: A sphygmograph consists of a lever, the short arm of which is pressed over the vessel to be tested, the long arm carrying the recording appa-The amplitude of the tracing depends on the relative lengths of the arms of the lever, the size of the vessel, the variations in the arterial tension, the exactitude of the placing of the receiving pad over the vessel, and the degree of pressure exerted on the vessel. Too great pressure tends to suppress the weaker elements of the tracing, too light pressure fails to develop the stronger. The best results are to be obtained by varying the pressure during the application of the instru-Apparent contradictions in its renderings are due to lack of skill in its adjustment. The length of the tracing depends on the frequency of its ventricular contraction and the rapidity of the motion of the recording paper.

There are four factors which influence the shape of the tracing, viz., the amount of blood thrown into the aorta at each ventricular contraction, the condition of the aortic valve, the elasticity of the great vessels, and the state of the peripheral circulation taken as a whole —not only that distal to the vessel under examination. Relaxation of the splanchnic vessels, for instance, will lower the tension in the radial artery, just as opening a faucet in the kitchen will lessen the water pressure in the second story. A normal radial sphygmogram consists essentially of an almost vertical upstroke, a somewhat acutely rounded primary wave followed by a notch and a second elevation, known as the tidal wave, at a considerably lower level, a second notch (the dicrotic) marking the end of the ventricular systole, and a third well-marked elevation, produced by the recoil

<sup>(9)</sup> Med. Record, Sept. 9, 1911.

of the great vessels, known as the dicrotic wave. All the tracings used for illustration were taken with the Dudgeon instrument.

Increased peripheral resistance causes lessened amplitude of the tracing from lessened variation in the tension and often lessened diameter of the artery. The tidal wave and the dicrotic notch appear higher in the

tracing and the line of descent is gradual.

Lessened peripheral resistance shows an increased amplitude of the curve from increased variation in the tension and larger size of vessel, after an obliteration of the tidal wave, low position of the dicrotic notch, and increase in size of the dicrotic wave. The sphygmomanometer may show a low, normal, or even increased systolic pressure. Diminished elasticity of the great vessels produces a flat-topped systolic tracing or one in which the primary and tidal waves are fused into an obtuse rounded curve. The flat-topped tracing is often initiated by a sharp point due to an oscillation of the spring of the instrument caused by the very sudden rise in tension. The dicrotic notch is low down and the dicrotic wave greatly lessened or suppressed, owing to the small amount of blood forced into the periphery by the inelastic great vessels. The sphygmomanometer in such cases, provided the cardiac output remains normal, shows an abnormally high pressure because, owing to the lessened distensibility of the great vessels, a larger portion of the blood mass is forced into the peripheral vessels during ventricular contraction, resulting in increased velocity of the blood-stream. The sphygmogram shows that the postsystolic tension falls rapidly below normal.

The effect of a narrowing of the aortic orifice is to cause obliquity of the first line of the tracing. Aortic regurgitation shows a tracing of large amplitude, low position of the dicrotic notch, and the diminished indication of the dicrotic wave, the extent to which these latter characteristics are developed furnishing a measure of the leakage. In a case of compensated aortic regurgitation the left ventricle is dilated and the blood mass thrown into the aorta is abnormally large; friction, and, therefore, pressure rises during the cardiac

systole. But this increase is offset by the lessened postsystolic pressure. The effect of aortic regurgitation on the postsystolic portion of the tracing is the same as lessened elasticity of the great vessels.

Low systolic pressure may be due to three factors: lower peripheral resistance, inelastic arteries, aortic re-

gurgitation, or any of these combined.

The sphygmograph enables us to recognize three distinctly contrasted types of arterial high pressure: one confined to the systole followed by postsystolic low pressure with feebly developed or absent dicrotic wave and due to inelastic great vessels, aortic regurgitation, or both.

Sphygmograms of Different Arteries. O. Müller and E. Weiss' have examined the sphygmograms given by the different arteries and sum up their work as follows: The pressure-pulse of the left ventricle has, according to Straub, a completely smooth rise and fall in the horizontal part of which only small notches appear in consequence of the systole of the auricle and the first heart tone. When the pulse passes into the root of the aorta it receives, according to Frank, first an initial variation in the ascending part depending on the peculiar vibrations of the aortic system. It retains its systolic apex as it appears in the ventricle but this is followed by two waves depending on reflections from the adjacent parts of the vessel.—the so-called interval strokes. The first of these two interval strokes often exceeds the essential chief point, and may then easily be confused with the systolic principal stroke. As a rule, after, but frequently simultaneously with the first, and always with the second interval stroke, the pulse-wave sinks rapidly to the so-called incisura which is due to a reverse current occurring with the closure of the aortic valves, and a negative oscillation combined with it is produced. The closure of the valve is followed by a marked agitation of the column of blood which presents itself in the form of one or more secondary oscillations with rising blood-pressure. There follows an abrupt fall of the pressure to the minimum before the occurrence of which

<sup>(1)</sup> Archiv, f. klin, Med,

two other small increases of pressure occur, indicating the contraction of the auricle and the ventricle (during

the period of closure).

When this so-called central pulse passes into the subclavian in order to reach the upper extremity it retains at first in general the same form. Only slight marks from the peculiar vibrations of the large vessel cause in the part behind the incisura a moderate distortion of this pulse-picture. In the further passage through the upper extremity one after another of the details of the central pulse are obliterated by friction and last of all the incisura with the secondary oscillation following it. These are retained as a rule even to the arteries in the fingertips and correspond to the variation which we are accustomed to designate as dicrotism. If the tone of the vessel is high the rapidity of the pulse-wave is increased in a similar manner; that is, the retardation of the pulse decreases and the central essential form is propagated further into the periphery. If the tonus is slight the reverse occurs and all the waves, even the dicrotic, are obliterated; and this, although it becomes smaller, strikes the eye more prominently as the only elevation in the curve.

When the central pulse passes through the carotid into the vessels of the head essentially the same phenomena occur as in the upper extremity. In the large vessel some small details due to the peculiar vibrations, particularly in the oscillations following the incisura, are changed. In other respects the central basic form remains, gradually disappearing in the vessels of smaller caliber. If the tonus is high it disappears later, if it is low it disappears sooner.

Matters are different in the course of the pulse-wave to the lower extremity. Even in the abdominal aorta the form of the pulse at the base of the aorta is markedly changed even though the details can still be sufficiently recognized. The pulse enters the femoral in a much more modified form than in the subclavian and carotid; hence the peculiar vibrations of this powerful vessel change it much more than those of the carotid or subclavian. To this is added the fact that the femoral

runs for a greater length than the carotid or subclavian as a powerful undivided vessel, and hence its peculiar vibration can reach a more marked expression corresponding to the longer course of the blood-channel. As a result the pulse at the ankle is extraordinarily free from central influences but shows very plainly those of the periphery, and hence has quite a different form from that of the head or the wrist. This form is essentially a depression following the chief elevation and only slightly indicating the incisura, with a marked mountainous wave. Following this it shows a depression and runs a smooth course to the end. But as the small arteries produce no further peculiar vibration which can actively affect the pulse-curve, these peculiarities, depending on the peripheral action, finally become obliterated, and the pulse consists only of a moderately rapid rise, a somewhat slower fall, and a final portion running almost horizontal. In this peripheral part we have reached again a picture that is essentially similar to the course of pressure in the left ventricle, as far as the finest sphygmograph can obtain results; thereafter a uniform movement occurs in the capillary system.

The following practical consequences may be drawn. The possibility of securing at the same time a purely central and a distant peripheral pulse in healthy men as well as patients affords the prospect of studying the activity both of the heart and the vessels in the intact body in a better way than was formerly possible. the central pulse we obtain information with reference to the pressure and course of the current in the aorta during a heart-beat, as well as with reference to the changes occurring in these magnitudes. So, chiefly by continuing the investigations it will be possible to secure a relative measure for changes in the volume of the beat. Further, the period of closure of the heart can be estimated. Finally it does not seem impossible by means of the central pulse to make important observations on patients with heart disease.

By the investigation of the pulse at the periphery a new method is afforded for study of changes in tone of the circulatory system in the most varied parts of the body. The simultaneous estimation of the changes in the delay of the pulse and of the form of curve furnishes a double assurance for the accuracy of the conclusions drawn. The method affects the artery itself and is to that extent not dependent on changes in the venous current like plethysmography. Also simple changes of tone of the vessel-wall can be recognized with the sphygmograph of Frank, which have not yet led to changes in the caliber of the vessel. There is thus afforded a prospect of a new, certain and minutely accurate method of determining the function of the vessel.

Significance of Form of Pulse. From investigations made by E. Veiel<sup>2</sup> on the form of pulse as shown by the mirror sphygmograph of O. Frank the following conclusions are drawn:

On increased contraction the secondary waves of the pulse are increased and become more distinct, while with relaxation of the artery they are rare and less distinct. Arteriosclerosis tends to dissipate the secondary waves. In chronic nephritis, either with or without rise of bloodpressure, in neurotic patients and after the administration of digitalis he found the secondary waves increased and more distinct. Corresponding to the above statement one must here take into consideration the changes in the condition of contraction, the hypertrophy and changes in the tone of the arteries.

The pulse-form which is shown by O. Frank's mirror sphygmograph admits the possibility of drawing conclusions as to the anatomic and functional changes of the vessel-wall. With its finer lines it permits a deeper insight into the degree of injury to the vessel than was formerly the case, but the tracing of the pulse alone permits no decided conclusion, as is shown by the fact that the pulse of contracted arteries is exactly similar to that of tonic ones. Here it is necessary to supplement the sphygmograph with other methods such as plethysmography, tachography, and sphygmomanometry, but then it will, in the new form which O. Frank has given it, become a valuable diagnostic aid in the investigation of the circulation.

<sup>(2)</sup> Archiv. f. klin, Med,

Venous and Esophageal Pulse in Left Heart Affections. L. Bard<sup>3</sup> notes the insufficient attention given to the effect of the left heart on the venous and esophageal pulse. He has shown that important facts can be elicited by a comparison of the tracings from these two sources. This can seldom be secured by simultaneous tracings but it is possible to superpose those taken from the jugular and the esophagus at different times, taking care to select phases of the heart's action that are identical or at any rate comparable with each other. He reviews the results obtained by comparing the two kinds of tracings in normal cases and finds that there is a great deal of similarity between the waves represented in the two cases. There are the same positive waves, presystolic, systolic, telesystolic, and protodiastolic, and the same two principal depressions, the mesosystolic, and the mesodiastolic with a weaker and shorter depression in the intersystolic pause. There is no doubt that the presystolic wave is due to the contraction of the auricle. and the jugular representing the right auricle is not exactly synchronous with the esophageal which corresponds to the action of the left auricle. The latter terminates a little sooner than the former. The wave in the jugular is attributable to the reflex current in the vein following the closure of the mouth of the veins by the contraction of the auricle. Explanation of the esophageal wave is more difficult. A priori it would appear that contraction of the auricle ought to produce a depression, but the wave may easily be due to change of shape of the auricle by which it bulges into the esophagus.

The apparent synchronous occurrence of the two waves is to be explained by the fact that the right auricle actually contracts a little sooner but the wave must travel farther to expand the jugular, and thus the difference of 0.06 second in the occurrence of the contraction is used up so that the waves appear synchronous.

Bard, however, attributes this synchronism to the contraction of the sinus venosus which antedates the auricular contraction but which produces no esophageal pulse.

<sup>(3)</sup> Sem. Méd., May 29, 1912.

On the other hand, the cessation of the auricular systole on both sides is almost simultaneous so far as the heart is concerned, but the wave from the left auricle represented by the esophageal pulse terminates earlier than that in the jugular because this reaches the jugular later.

The second wave in both the jugular and esophageal curves corresponds to the early period of the ventricular systole. It is occasioned by the ventricular contraction which forces shut the auriculo-ventricular valves which have already closed and are thrown into vibration, producing a characteristic sound. In the esophageal pulse the wave occurring at this time is usually double, part occurring before the tension of the valves, part after, but frequently coalescing so that no depression between them is noticed. This wave is followed by a depression in the middle of the systole and then comes the final wave which Bard divides into two, designating them as telesystolic and protodiastolic, the two being separated by a slight depression. In the jugular this distinction is less marked.

A comparison of two normal tracings shows the following differences: The jugular has three elevations and three depressions corresponding to P, S, and D, or the presystolic, systolic, and diastolic waves. The esophageal on the other hand shows five elevations of which the third follows the systolic after a very slight depression, and the fifth is little but a condition of the diastolic which is here divided into the teleosystolic and protodiastolic.

In discussing the effect of disease of the left heart on the pulse-tracings Bard finds that the effect varies somewhat according to the degree of change introduced into the circulation. The changes in the esophageal pulse are more complicated than those produced in the venous. Hypertrophy of the left heart in its early stages exerts comparatively little effect on the left auricle, while the right auricle suffers much the same changes as the left ventricle. The consequence is that the jugular pulse presents somewhat characteristic changes, while the esophageal pulse remains practically normal. The changes in the jugular pulse are as follows: In conse-

quence of the more forcible action of the right auricle the first or presystolic wave is more abrupt and more pronounced than the succeeding ones. This presystolic wave is not only higher but its duration is longer. It begins earlier and is prolonged beyond the beginning of the systole. This modification is found in beginning renal disease and to a less degree in pure stenosis of the aortic orifice, which entails a similar but less degree of hypertrophy of the left ventricle.

With the exception of this considerable hypertrophy of the right auricle, which is peculiar to the early stages of the renal heart, all other lesions of the left heart sufficiently pronounced to disturb the venous circulation and to create in it a certain degree of stasis, produce a special modification of the tracings which Bard has designated as diastolic stasis as contrasted with the systolic stasis of the lesions of the right heart. The jugular tracing presents in this case a very characteristic aspect, characterized by the appearance on the one hand of a marked accentuation of the negative mesosystolic wave or depression, which results in the effacement of the physiologic telesystolic wave, and on the other hand by the production of a raised plateau occupying the entire diastole, the presystole and the protosystole—a plateau always presenting undulations produced by the three ordinary waves corresponding to these phases, waves more or less unequal according to the lesions, according to the case and according to the degree of stasis.

At a more advanced stage of the disease, when the asystole has reached its extreme limits, the aspect of the tracings changes completely. When there is not a concomitant arrhythmia it is reduced to two successive waves. These at first are unequal. At a slightly later period the tracing appears under the form of a double undulation, often so uniform and regular that it becomes impossible, without a clear distinguishing mark, to recognize the phase of the circulation to which each of the two waves belongs. Both are nearly equal in height and duration, and constitute the venous pulse. By the aid of comparative tracings of the arteries it can be determined that one of these waves occupies almost

exactly the entire systole and the other the entire diastole; the depressions which separate them more or less deeply are always short and angular in proportion to the more or less high degree of tachycardia which always exists in such cases.

It is impossible in such cases to determine the corresponding form of the esophageal pulse. The patients are in a serious condition, affected with marked dyspnea, so that a comfortable examination of the esophagus is rarely possible, not only because it occasions discomfort. but because it does not permit sufficient tracings. The author gives the following interpretation of this severe form of asystole of the venous pulse. There is a general dilatation of the cavities of the heart, affecting almost equally the auricles and the ventricles; the veins, themselves dilated, constitute merely but a prolongation of this dilatation. At this stage the waves due to shock have all disappeared, including both those of the auricle and those occasioned by the systolic and protodiastolic movements of the ventricle. There remain only the cessation and reinstatement of the flow of blood which permit it progression by successive pulses, parallel with which the swelling of the jugulars occurs. The stops coincide, one with the appearance of systolic pressure in the ventricle, the other with the almost immediate filling of the ventricle at the beginning of diastole. The pulses coincide with the lowering of the base of the heart and with the diastole of the ventricles. To sum up the influence of lesions of the left heart on the venous pulse we have three distinct types:

1. The accentuation and prolongation of the auricular wave, an essentially active process connected with a compensatory hypertrophy of the right auricle, occurring in primary hypertrophies of the left ventricle, especially those of renal origin, but in some cases those of an arterial origin, either acrtic or myocardial.

2. The type of diastolic stasis characterized by a diastolic plateau, which includes the protosystole and is preceded by a marked telesystolic collapse; a type connected with hyposystolic circulatory affections of the most various valvular lesions of the left heart. The

variable relations of intensity and character of the three waves, whose succession creates the diastolic plateau, constitute secondary varieties in relation with the nature of the original lesion.

3. The type of double stasis, systolic and diastolic, characterized by a pulse with uniform undulations, connected with advanced asystole and general dilatation of

the heart arising from the most various lesions.

Bard describes the more complicated changes in the esophageal tracings and sums up as follows: The effect of lesions of the left heart on the esophageal pulse presents distinct types which derive all their value from a comparison with the corresponding jugular pulse:

1. At the period of adaptation with compensatory hypertrophy and complete tolerance the renal heart causes no modification in the tracings. Mitral insufficiency, mitral stenosis and aortic insufficiency each pro-

duce special modifications in it.

2. At the hyposystolic period the tracings may show either the temporary deficiency of the left auricle, or more frequently a type of systolic stasis, or more exactly characteristic telesystolic and protodiastolic stasis.

3. In very advanced asystole the tracings cannot be utilized and one must generally be content with the jugular pulse, which is, moreover, sufficiently characteristic. Sometimes, however, the comparison of the two pulses may be useful in the diagnosis of aortic insufficiency either in the very rare cases where this may be simulated by an insufficiency of the pulmonary artery or in those which, on the other hand, are quite common, in which a double murmur can be distinguished only with difficulty from a double pericardial friction sound with the quality of a murmur.

Either pulse, and still better their comparison, in consequence of their sensibility to degrees of asystole, may furnish in prognosis and in therapeutic indications a basis of estimation and of direction which cannot be furnished in the same degree either by percussion, auscultation, or even extensive palpation. The author believes that the facts which he has established are of importance for the explanation of the physiology and

the mechanism of the pathologic changes which compensatory hypertrophy produces in the contraction of the heart.

Electrocardiography. The construction and use of the electrocardiograph were described in detail in Volume 1 of the *Practical Medicine Series* for 1912. T. Lewis<sup>4</sup> discusses the use of this instrument and the clinical deductions to be derived from its findings, and closes with the following summary:

To sum up, galvanometric examination of the heart is important from many points of view. It may give indications of enlargement of the walls of one or other cardiac chamber; it may accurately locate small lesions in the musculature. It informs us when the heart beat starts at the normal impulse center or away from it; in the last named condition it tells us that the rhythm is no longer under the normal nervous control-a fact which is of fundamental importance in the management of our case: it tells us within certain limits where the new beats have their origin. It gives us a separate record of contraction in auricle and in ventricle, and accurately defines the time relation of contraction in one chamber and the other; thereby it frequently elucidates physical signs which otherwise remain obscure. It provides us with a perfect means of ascertaining the functional efficiency of the auriculo-ventricular bundle, the sole conducting tract upon which the ventricle depends for the reception of impulses which start its contractions. allows us to differentiate between separate forms of slow and rapid heart action, which are of totally different significance. It provides us with an analysis of every form of cardiac irregularity, an analysis which is unrivaled in its precision by any other method. the information derived from it relates essentially to the condition of the muscle, the method is often helpful in the diagnosis of lesions of the valves. It brings us into nearer contact with the functions of the heart muscle than does any other clinical method; it is a precise means of studying the heart as a living and moving organ.

The information obtained by electrocardiography is

<sup>(4)</sup> Brit. Med. Jour., July 13, 1912.

not, as commonly thought, of purely scientific interest in the analysis of disordered heart action. It has a great and growing value in the practical management of patients. There are few heart cases in which our knowledge is not added to by its employment, and in a steadily increasing percentage facts which are essential, if sound prognosis and treatment are to be attempted, are elicited. The time is at hand, if it has not already come, when an examination of the heart is incomplete if this new method is neglected.

Its Use in Arrhythmia. Cluzet and Rerappu<sup>5</sup> discuss the uses of the electrocardiogram in arrhythmia and

make the following statement of its clinical value:

1. In the diagnosis of arrhythmias the electrocardiogram may allow the recognition of a mitral stenosis masked by the arrhythmia by means of the exaggeration of the amplitude and even by the simple presence of the wave A. By the persistence of F and the exaggeration of I and F under the influence of a cardiac tonic the existence of a primary renal disease may be revealed. Therefore it is of value in the differential diagnosis of myocarditis.

- 2. In the prognosis of myocarditis modifications of the tracing under the influence of strophanthus, and the passage from type 1, characterized by scarcely visible waves and fibrillations, to type 2, characterized by the exaggeration of 1, and especially by abnormally close F; and from that to a type practically normal allows the conclusion that the myocardium is capable of reaction and of struggle. On the contrary, the absence or feebleness of the modifications must render the prognosis much more serious.
- 3. As to the action of strophanthus it appears to result from the author's researches that this medicine, which is often given without conviction of its value and simply that the patient may not be without medicine, often has an incontestable action. It increases the amplitude of I and of F very rapidly, but its most durable effect is the regulation of the heart.

<sup>(5)</sup> Lyon Med., Nov. 5, 1911.

Its Use in Diagnosis. A. Strubel<sup>6</sup> advocates the instrument for the diagnosis of the earliest forms of cardiac degeneration and disturbance of function. He says that the electrocardiogram permits us very often to say early in the thirties that a man possesses a functional condition of his heart, which plainly does not correspond to his age. Furthermore, by a combination of three methods, the estimation of blood-pressure by the sphygmomanometer, the examination by the x-ray and by the electrocardiogram, we are in a position under some circumstances to furnish very exact information as to the progressive character and the degree of progress of angiosclerosis (von Basch), and later of arteriosclerosis.

1. If in a patient a permanent rise of blood-pressure appears, with a perfectly preserved or even higher negative variation and an auricular summit not increased, we may make the diagnosis of a still complete sufficiency of the heart muscle, with a beginning angiosclerosis (sclerosis of the small vessels, von Basch) with well-preserved heart muscle; and an increased exertion of the heart, with presumable or actual beginning hypertrophy, not yet demonstrable by percussion, and in some cases

not even by the x-ray.

2. If we have a permanently increased arterial pressure with a good terminal variation and a raised auricular summit, combined with a clinically demonstrable slight dyspnea, then we may diagnosticate angiosclerosis, beginning hypertrophy of the heart (not yet recognizable by percussion and the x-ray); secondary insufficiency of the heart (according to von Basch), beginning overfilling of the lesser circulation (beginning dyspnea, elevated auricular summit).

3. Permanently increased arterial pressure, a terminal variation becoming weaker or disappearing, an elevated auricular summit, dyspnea, perhaps means a beginning extension of the sclerotic process to the heart muscle, a

deterioration of the same.

4. Markedly increased arterial pressure, negative variation, with increased auricular summit, a greatly

<sup>(6)</sup> Deutsche med. Wochenschr., May 1912.

increased initial variation, dilatation of the aorta in the Röntgen picture, means a diagnosis of angio-arterio-sclerosis, sclerotic degeneration of the heart itself and sclerosis of the aorta.

The Sphygmomanometer demonstrates blood-pressure. The instrument was probably first devised by Harrison in 1834. The first clinical model seems to have been that of von Basch, which was improved by Potain. In 1899 Gaertner devised his tonometer (so-called from tonos, vibration). The difficulty with the Gaertner method is that the finger should be warm, the ring fit

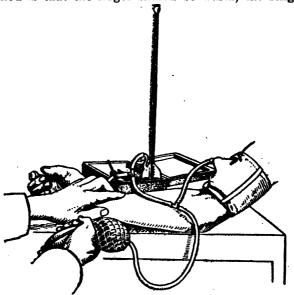


Fig. 2.—Cook's modification of the Riva-Rocci instrument.

tightly, and there should be several rings so as to be adapted to fingers of various sizes; while pressure may produce paralysis of the vessels, so that the blood may be slow in returning. Compression by the arm-piece is more satisfactory. In fact, it may be said that in newer instruments the finger rings have been rejected.

Cook's modification of the Riva-Rocci instrument consists of an upright manometer mercurial tube, terminating in a bulb, which when in use rests in a wooden socket or stand. To the bulb is attached rubber tubing, connected with two rubber bulbs. This tubing is also con-

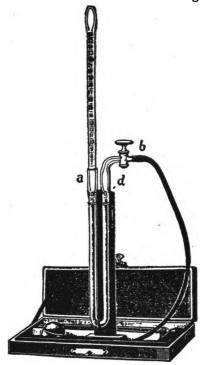


Fig. 3.-Sahli's instrument.

nected with a rubber ring about two inches wide, which encircles the arm. The instrument should preferably be used when the patient is in the recumbent position. There are three objections, according to T. E. Satterthwaite, to this model: the arm band is too narrow for suitable compression, and the tube is delicate and

<sup>(7)</sup> Med. Rev. of Reviews.

liable to be broken. The bulb has to be filled with mer-

cury from time to time. (Figure 2.)

The first two of these objections are overcome in the Sahli and Stanton instruments. The latter also has advantages over the Riva-Rocci model, in that it is more durable, easily and quickly managed, and more portable.

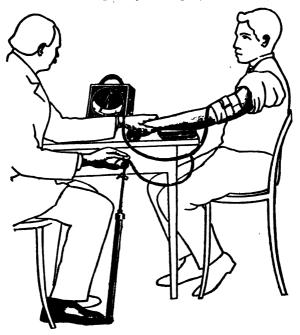


Fig. 4 .- von Recklinghausen's instrument,

It is not necessary to remove the mercury from the tube. (Figure 3.)

Stanton's armlet is made of canvas, reinforced with strips of tin, and held in place by two leather straps. This armlet is connected by means of a stiff rubber tube with a metal manometer, to which the column of mercury is fastened as in an ordinary house thermometer. cistern communicates by means of a metal tube with the mercurial column. The screw cap of the cistern is provided with a metal valve and is connected also with the rubber armlet at one end and at the other with a rubber bulb used as an air-pump. A stop-cock shuts off the air in the rubber tube, while a screw valve allows the air to escape slowly from the closed air-system and the mercury to return to the cistern.



Fig. 5.-The "Tycos."

The air is pumped in by a double bulb syringe similar to that used with the thermo-cautery. A variation of 5 to 15 mm. of mercury may be expected in cases of high pressure; otherwise the instrument has a high degree of accuracy.

The best way to get an idea of the value of the instrument is to test it on oneself. From the experience of Satterthwaite, the Riva-Rocci maximal systolic pressure varies from 30 to 40 mm. of mercury in a single day, and the diastolic still more—40-45. Indeed, there may be a variation of 40 mm. in 10 successive trials. But

there is no doubt that the variation is less in the newer instruments. The von Recklinghausen is an example of a superior instrument, but it is not fitted for clinical

use. (Figure 4.)

One of the more recent models is that of Erlanger. It makes use of the armlet, the Politzer inflater and the Ushaped manometer, but has in addition a Ludwig kymographion and tambour, the interior of which is in direct connection with the tubes and chambers which convey the air to the mercurial column. By the use of the kymographion there is an accurate record of both systolic and diastolic pressure. The apparatus is elaborate and better suited for the laboratory or hospital than for private use. There is an aneroid instrument in extensive use that is an improvement upon the Potain, -the Tycos of Rogers. This answers well for comparative measurements of pressure, is cheap, may be carried in the pocket, and is used extensively by the medical examiners of insurance companies. It consists of a gauge, a sleeve, an inflating bulb and two short pieces of rubber tubing. These, when assembled and ready for use, constitute an instrument which is simple and so compact as to be contained in a leather case about the size of a physician's pocket case. It is said by the maker that for accuracy and sensitiveness the Tycos has all the advantages of the best mercurial instrument; that for compactness and durability it far surpasses them, and that it is practically indestructible. (Figure 5.)

The model of the Faught instrument is simple, strong and not likely to get out of order. It employs a U-shaped mercurial column and is not susceptible to uncontrollable variation caused by atmospheric changes and other

causes. It is deservedly popular. (Figure 6.)

Satterthwaite's modification of the Riva-Rocei instrument has the long, unjointed Riva-Rocci tube, but it is attached to the door of the box, so that when open the box and door make a firm support for the tube. order that the mercury may remain in the reservoir when not in use, the latter is fitted with two glass stop-cocks. Violent oscillations in the mercurial column are prevented by using a rubber tube that is unusually heavy. A broad cuff, 7½ inches in width, something on the pattern of the Recklinghausen, but larger, is used. Connected with the heavy tubing is a short, light, flexible rubber tube fitted with a clamp to regulate the ingress and egress of air. Air is pumped into the cuff by the double bulb of the thermo-cautery apparatus. When the box is opened, and the cuff and tubings are removed, they are all connected and available for immediate use.

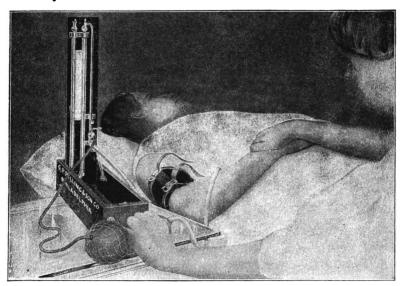


Fig. 6.—The Faught instrument.

In this instrument the question of diastolic pressure is of little account. Under the compression of the rubber bulb the column of mercury rises slowly as the pulse fades away, and when it has disappeared the column remains at a standstill. This steady rise and fall of the mercurial column is due to the use of very heavy rubber tubing. This instrument is especially adapted for office work. If desirable, however, to note diastolic pressure, a special indicator, known as the Fedde diastolic indicator, has been devised for the purpose. (Figure 7.)

George Bachmann<sup>8</sup> has described a new aneroid instrument devised by Pachon of Paris and known as the sphygmometric oscillometer, which has been designed with the idea of overcoming the errors seen in instruments of the Riva-Rocci type, on the theory that mercurial manometers are not sensitive enough to demonstrate the amplitude of oscillations in noting diastolic

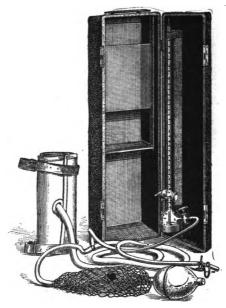


Fig. 7.—Satterthwaite's office sphygmomanometer.

pressure. The essentials of this instrument (Fig. 8) are a metallic box hermetically sealed, and containing in its interior an aneroid dome connected with a lever. M is an aneroid manometer, which indicates the level of the arterial pressure. Box, manometer, dome and cuff are connected by tubes. The pressure can be raised by the pump or lowered by allowing the air to escape at S. The cuff and the dome can be cut off from each other.

<sup>(8)</sup> N. Y. Med. Jour., Feb. 4, 1911,

The armlet is adjusted as usual, then air is pumped in until the manometer registers a degree of pressure above ordinary arterial pressure. The valves are then manipulated until the level N denotes an excursion of about one degree on the dial. This indicates the return of the pulse at the compressed point, and therefore the maximum systolic pressure, which is now read on the manometer M. To determine the minimal diastolic pressure the air valves are again manipulated until the largest excursions of the lever have been reached, when the manometer M records the diastolic pressure. In this respect Bachmann thinks the Pachon the most satisfactory instrument for determining diastolic pressure.

The author arrives at the following conclusions:

1. The sphygmomanometer has two uses: one for the

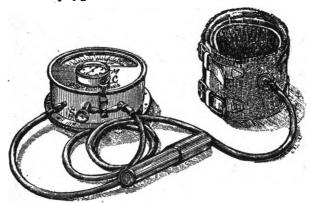


Fig. 8.—Pachon's sphygmometric oscillometer.

physiologic laboratory or hospital, the other for ordinary practice. Instruments that may be used advantageously for one purpose may not be applicable for the other. Even in ordinary practice one should be guided in the choice of an instrument by the degree of accuracy required; the facilities available for keeping it in good working order; also its portability.

2. The von Recklinghausen is a good example of a

laboratory instrument, the Faught of a clinical.

3. No physical examination is complete without a record of the blood-pressure. It is also very helpful in the diagnosis and management of cardiovascular and renal diseases and toxemias.

4. In experimental medicine the sphygmomanometer is especially useful in the pharmaco-dynamics of cardiovascular remedies: also in determining the effects on the circulation of altitude, posture, physical exercise, baths

and diet, etc.

5. No one of the sphygmomanometers is absolutely accurate. The errors in estimating maximal pressure vary from 3 to 20 mm. or more of mercury. The diastolic readings have a greater error. But by taking the mean or so called pulse-pressure in such cases the errors may

be materially reduced.

6. When considerable variations are taking place in the blood-pressure, as often happens for various reasons, several tests should be made, at longer or shorter intervals, of the systolic alone or the systolic and diastolic in association, according to the degree of accuracy required. An average of these readings constitutes the socalled pulse-pressure, the best criterion of pressure available at present.

Sphygmomanometry Technic. C. Finck<sup>1</sup> calls attention to the importance of determining the pulse-pressure by the measurements of both the systolic and diastolic pressures. For the determination of the diastolic pressure he advocates the oscillatory method, which is facilitated by having a large cuff divided into two air-compartments. The oscillatory method with these modifications has given him better results for the determination of the systolic pressure than the palpatory method, and it is the only method which permits the exact and easy determination of the diastolic pressure. By its application every personal factor in the estimation is removed.

Automatic Reading Device. B. R. Hoobler<sup>2</sup> describes an automatic device for reading systolic and diastolic

The pulse-pressure is not a mean but the difference between the diastolic and the systolic pressure.—S.

Lyon Med., June 23, 1912.

Med. Record, Dec. 30, 1911.

blood-pressures. There are in the system three air-tight rubber bags connected with one another, viz., the rubber bag in the upper arm cuff (A), the rubber bag in the lower arm cuff (B), and the third one (C), which for convenience may be attached to the outside of the lower arm cuff. (Figure 9.)

In order to operate, the cut-off between the upper and lower arm-cuff is opened and air is pumped in as in fill-

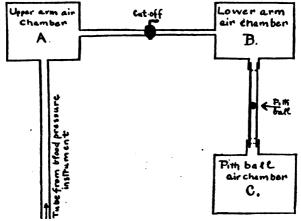


Fig. 9.—Diagram showing the air-chambers in the "double cuff" arrangement for reading systolic and diastolic blood-pressures.

ing the ordinary upper arm-cuff of any instrument. Instead, however, of filling the upper arm-cuff only, the air is passed into the lower arm-cuff as well as into the extra bag leading from it. The air is passed in continuously until the pressure in all the bags is about 100 mm. mercury, as shown by the blood-pressure instrument. At this point the cut-off between the upper arm-cuff and the lower arm-cuff is closed, making now two distinct air-tight chambers, the one in the upper cuff (A) and the other made up of the rubber bag in the lower arm-cuff (B) and the bag connected with it (C). The two last mentioned bags are connected by the pith-ball tube (E).

Oscillations of the pith-ball indicate a pulse in the forearm and cease when this is obliterated. At this point the

height of the mercury column is read for the systolic pressure. Or the air may be pumped into the upper cuff far above the true blood-pressure and allowed to escape through a needle valve, By this method, as soon as the pulsations appear in the forearm, they are recorded by the instant oscillations of the pith ball, this being the systolic reading. These results are identical whether taken at the cessation of the pith-ball oscillations or at the first appearance of such oscillations.

If the operator now opens the shut-off between the upper and lower arm bags and watches the oscillations of the pith ball as the air is permitted to escape through a needle valve, the point at which the oscillations are greatest is the place at which the diastolic pressure is read, according to the method devised by Fedde and referred to above. The author's conclusions follow:

1. By means of this additional cuff, systolic bloodpressure may be accurately read without the use of the fingers, thus eliminating all personal error and standardizing all blood-pressure readings.

2. Diastolic pressure readings are made with the same

ease and accuracy.

3. The cuff may be attached to any outfit now owned. whether aneroid or mercurial in type.

4. It is extremely simple and takes up but little space.

5. It may be used on the legs of children, thus overcoming the difficulty of small arms.

The Tycos Instrument. H. E. Rogers<sup>8</sup> describes the Tycos instrument of O. H. Rogers, which acts on the principle of the aneroid barometer. The pressure, instead of being atmospheric, is exerted by means of the inflating bulb and the armlet, the armlet containing a collapsible rubber bag. This rubber bag is connected with the manometer by means of a rubber tube, while a second tube connects the rubber bag with the inflating bulb. The use of the two tubes thus fully equalizes the pressure, so that no excessive exertion is put on the diaphragm, causing a complete circulation of the air by reason of a free inflow and outflow.

This rubber bag is 5 by 91/2 inches, is sewed in a soft

<sup>(3)</sup> Amer. Med., May, 1912,

flexible sleeve of good quality and strength, the whole being forty inches long, tapering from five inches at the extreme end to about two inches at the rounded end.

(a) Application: In the standing posture the sleeve containing the rubber bag is placed around the left arm above the elbow over the brachial artery; in the recumbent posture it is wrapped around the left leg over the femoral artery and never on the arm.

(b) To determine the systolic pressure: Palpate the pulse of the radial with the fingers of the left hand; then exert the pressure with the inflating bulb, held in the right hand; observe the amount of pressure required to collapse the arteries so that the pulse is lost at the The point at which this occurs indicates the systolic pressure.

The best way to try conclusions is to advance the pressure beyond the point where the pulse is obliterated, to open the leak valve slowly and carefully, thus permitting the air to escape, until you reach the point at which the

pulse returns. This is the systolic pressure.

(c) To determine the diastolic pressure: Observe the systolic pressure; that is, the point at which the pulse returns; turn off the back valve and secure the reading; the hand on the dial will then oscillate, due to the arterial impulse, between the point at which the pulse first appears, the systolic pressure and the point at which the artery regains its normal fulness and volume. The point at which the greatest oscillations occur is the diastolic pressure. The object of obtaining the diastolic pressure is that the pulse-pressure may be calculated.

(d) To determine the pulse-pressure: Take the systolic, then take the diastolic pressure, and subtract.

namely,

Systolic.																				 		130
Diastolic	 •	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	104

Oscillometer. H. J. Johnston-Lavis<sup>4</sup> states his experience with Pachon's instrument. He says: "I have for some time been using this instrument, and have made

<sup>(4)</sup> Brit, Med. Jour., Jan. 13, 1912.

several hundreds of observations with it during the season at Vittel and since at Beaulieu. In order to make it comparable I coupled it up with a Riva-Rocci mercurial manometer; we worked out a table of corrections, and these show very much higher readings for the Pachon than for the mercurial, and, like all instruments constructed on the aneroid principle, the errors are not proportionate. With the oscillometer it is quite as troublesome and uncertain to find the two critical points as with the Riva-Rocci. Furthermore, the time taken up in reducing the pressure to find these points is much greater, and if patients have high tension they complain a good deal of pain of the prolonged compression.

"The armlet of the Pachon instrument is incorrect—first, on account of its narrowness, and, secondly, because the application to the forearm does not cut off the circulation between the radius and the ulna. I soon abandoned this, and replaced it by the broad armlet on the upper arm. The old strap method of fixing this took too much time, and was too fumbling a process. I tried glove pressure-buttons, but the pressure on the arm, when closing them, was too painful for the patient. I then designed three blunt hooks and eyelet holes on a broad canvas strap, and this was carried out by Hawksley. It is ideal, being put off and on each in one movement.

"Another question still unsettled is, What is an average normal blood-pressure? I have adopted an empirical method which, though not scientifically correct; has working advantages. It is this: For every year of age after 15 allow 1 mm. of mercury, and add 100 to the number. Thus a person 15 years old, 115 mm.; one of 35 years, 135 mm.; one of 60 years, 160 mm."

Apparatus for Registering Heart Tone. R. Ohm<sup>5</sup> describes an apparatus for the photographic registration of heart tones. The instrument consists of a collector, a narrow tube, and a receiver which takes up the vibrations. The collector is constructed in a peculiar way. In addition to marked sensitiveness and ability to conduct the heart sounds it is arranged with special

<sup>(5)</sup> Deutsche med. Wochenschr., Aug. 3, 1911.

reference to the requirement that the disturbing tremulous movement in the sound-curve shall be avoided as

much as possible.

With the vibrating membrane of the receiver a mirror is connected in such wise that it reflects a ray of light on a photographic film so that the movements of the light ray will correspond to the vibrations caused in the membranes by the heart tone. In this way the heart tone is made to give a curve similar to those which are produced by the sphygmograph and electrocardiogram.

Orthodiagraphy. W. H. Fowler and W. T. Ritchies describe the method of orthodiagraphy of the heart and

aorta.

Apparatus and Technic. The source of energy for the x-ray tubes is a Snook high-tension transformer. The orthodiagraph is Groedel's modification of the Levy-Dorn apparatus, which consists first of a heavy upright, supporting a quadrilateral framework, in which move the supports bearing the two arms on which are fixed the tube and the screen, so balanced that it is a simple matter to move the screen and the tube in all directions with reference to the patient. The center of the tube, the center of the screen and the pneumatic pen are brought into alignment and firmly fixed. The resultant is a parallel projection of rays, which is carried round the organ under examination, and the outline is made by means of the pen on a sheet of paper fixed to the heavy board at the back of the apparatus.

To sum up, by the term orthoradiagraphy is meant the more or less exact measurement of various objects, outlines of which are thrown on a fluorescent screen by a pencil of x-rays. To obviate the distortion produced by the x-rays, which are propagated from the focal point of the anticathode in straight lines in the form of a divergent cone, it is necessary first of all to eliminate all but the central or ray of normal incidence, and after finding this it is carried round the outline of the object, in this case the heart and great vessels, and a record is

made of the silhouette.

Technic. If satisfactory observations are to be made,

<sup>(6)</sup> Edinburgh Med. Jour., September, 1912.

it is necessary that the room in which the examination is conducted should be absolutely dark. At the start the screen is moved rapidly in front of the whole precordial region in order to obtain a general idea of the position. form and size of the patient's heart. After this preliminary inspection, which need not last more than a few seconds, the patient is directed to hold his breath. and the record is taken. We commence by marking from right to left the upper border of the liver. The fluorescent screen is moved so that its opaque lead central spot coincides in succession with points upon the upper margin of the shadow of the liver, and each of those points is marked upon the surface of the paper by means of the pneumatic pen. The screen is then carried upwards, its central spot following the right margin of the shadow of the heart and great vessels, then over the apex of the right lung and down its outer margin to the starting point. The patient is now directed to breathe once or twice, and then to hold his breath again, in the same phase of respiration as that obtaining previously. While he does so the upper limit of the diaphragm on the left side, the outer border and apex of the left lung, and the left margin of the shadow thrown by the great vessels and the heart are marked successively on the paper. We find it most satisfactory to take the record at moments corresponding to full diastole and while the patient is holding his breath at the end of a tranquil inspiration, and subsequently, before switching off, to record the chief points of the cardiac outline during full inspiration and full expiration respectively. If the observer has had some experience in the technic, and if the case presents no special difficulty, such as that occasioned by pulmonary edema, pleural thickening, or enlarged mediastinal glands, the time required to obtain a simple record of the outline of the heart, lungs and diaphragm need not exceed thirty seconds. A somewhat longer time is necessarily required if we desire to record the form of the heart during different phases of respiration.

The current having been switched off, the lights are turned on, the percussion outlines of the heart and liver are mapped out upon the patient's chest wall, the fluorescent screen is replaced by the pointer, and by means of the latter, together with the pneumatic pen, the surface outline of the patient's chest, the percussion outlines and important landmarks, such as the episternal notch, the level of the third chondro-sternal articulation, the nipples, the apex-beat, the xiphisternum, the umbilicus, and the lower margins of the ribs anteriorly are marked upon the paper. In many instances it is well to supplement the dorso-ventral examination by screening the patient in various oblique positions, in order to determine more fully the relative size of the different cardiac chambers and to confirm or disprove the presence of an aortic aneurism.

The Normal Heart. On dorso-ventral illumination the lateral outlines of the normal heart are clearly and sharply demarcated by contrast with the clear area of the lung on either side. The cardiac outline, although varying somewhat in different patients, according to the sex, age and weight of the person, the conformation of the chest, and the position of the diaphragm, is of ovoid form, with its long axis directed obliquely downwards from right to left. On frontal illumination the long axis is directed from above downwards and forwards.

Pulsations. The extent of pulsation of the right auricle, as revealed by the systolic and diastolic excursions of the right lower curve, is slight. On the left side the pulsation of the aortic curve is normally greater than that of the pulmonary.

Respiratory Movements. The respiratory movements of the heart are more extensive than the pulsatile. The heart is indeed a freely mobile organ. A consideration of the anatomic relations of the heart, pericardium and diaphragm indicates that during inspiration the heart becomes longer and narrower, both the apex and the right auriculo-hepatic angle moving downwards and inwards. During expiration, on the contrary, the heart becomes shorter and broader. As a rule, however, the form of the cardiac outline changes in a striking manner with each deep respiration, and as tranquil respiration is associated with changes of similar nature, although of lesser degree, it is evident that an orthodiagram of a

heart loses much of its value, and may even be misleading, if we do not know in what phase of respiration the record was obtained.

Orthodiagraphy in the Diagnosis of Dilatation. M. Otten gives the results of investigations as to the significance of orthodiagraphy in determining a beginning dilatation of the heart, and sums up his observations as follows: An orthodiagram is of value only for the determination of the size, form and position of the heart when it so completely represents the position of the heart in the chest and the periphery that all necessary measurements can be determined and the form of the heart and aorta is made visible in their full extent. The indications of the apex of the heart is insufficient for this purpose.

That this requirement in healthy hearts may be practically always fulfilled, and in pathologic hearts with some exceptions on the attainment of a sufficient practical experience, has been shown by these investigations. The requirement must be most sharply emphasized, because orthodiagrams are at present drawn by a large number of investigators which, according to the above conditions, are in no respect correct and must be

regarded for that reason as quite worthless.

Whatever form of investigation is chosen in cardiac orthodiagraphy, whether the horizontal or the vertical position of the patient (sitting or standing), is immaterial, as all the factors which influence the size, form and position of the heart are equally observable in all three positions. The vertical method, however, deserves the preference, as it furnishes the best assurance of attaining as complete an outline of the heart as possible. It fails in some cases, however, because severely sick patients cannot maintain the simple dorsal position. Moreover, the fact that almost all measures of the heart give somewhat greater results in the horizontal orthodiagram as a rule than in an examination in the vertical position is practically of no importance. In testing a case only the normal figures for the same position should be taken for comparison.

<sup>(7)</sup> Archiv. f. klin. Med.

The orthodiagraphic size of the heart is determined by the measures introduced by Moritz. In addition to those measures which hitherto have been almost exclusively taken into consideration, Mr, Ml, L, the broad diameter must also be considered. Among the factors which influence the size of the heart in healthy individuals the body-weight and body-height are of the greatest importance. Their mutual relations show a certain constancy in the sense that the size of the heart as a rule increases parallel with them, so that for practical purposes the so-called normal figures for patients of a certain height may be assumed for the various measures.

The normal types introduced by Moritz and his school for the form of the heart in healthy individuals have shown themselves to be a reliable standard for the estimation of the form of the heart in pathologic cases. The constancy of these types is also affected to a not inconsiderable extent by the manifold influences to which they are subjected in the same way as the size of the heart. For the determination of the form of the heart, the form of the individual curves of the outline (including the aorta), the proportion of the length to the breadth (L:Br.), and the position of the heart with reference to the large vessels and to the horizontal line, are important.

The topographic position of the heart in the thorax varies even in healthy individuals between somewhat wide limits, and influences the form of the heart to a certain extent. It deserves for this reason careful attention in pathologic cases, because alteration of the position may under some circumstances produce changes in the size and form, which will be erroneously interpreted as dilatation.

The method hitherto commonly used of applying the normal figures as a standard for the size of the heart in pathologic cases has proved to be permissible only within certain limits. It can be shown that constancy in the relations of the length of the body and the size of the heart is only apparent in the average figures. Between these and the minimum or maximum values, on the other hand, there exist in persons of the same

height such remarkable differences that the judgment with regard to small deviations from the normal figures is very uncertain or indeed in some cases impossible. To determine in a certain case whether a dilatation is present or not is for this reason difficult or quite impossible, since even under normal conditions the variations of single measurements may amount to  $2\frac{1}{2}$  cm.

In severe diseases, with considerable increase in the several measurements of the orthodiagram, this inaccuracy need not cause much difficulty, but in doubtful cases, where only slight deviations in size occur, the application of the normal figures is of no value on account of the variations described, as has been shown by numerous examples. The application of normal measures fails at the exact point at which we expect the most from the orthodiagraphic estimation of the size.

Fortunately we may in such cases employ with advantage the constancy of the orthodiagraphic form of the The careful consideration of all factors which determine the form of the heart in healthy individuals shows us that pathologic hearts present at a very early stage changes of form of the single curve of the outline and striking variations in the relation of the length to the breadth and in the position of the heart relative to the large vessels, which are characteristic for certain diseases and indicate a dilatation of certain segments of the heart. To be sure, these changes are partly dependent on the modification of single measurements, but as a rule they affect such as hitherto have been little or not at all considered, particularly the broad diameter. At present it is generally customary to diagnosticate a dilatation of the heart exclusively on the determination of the distance of its right and left borders from the median line.

Further changes of form which occur very early affect the large vessels, the initial portion of the ascending aorta, and the arch of the aorta. For this reason it is necessary in orthodiagraphic tracings to complete the essential outline of the heart by the addition of the aorta also in the oblique diameter.

The importance of orthodiagraphy for the early recog-

nition of slight changes in the heart and aorta and of beginning dilatation consists in the fact that it permits the recognition of changes of form at a time when the diagnostic methods hitherto exclusively used cannot establish a departure from the normal.

The slighter these changes of form in the orthodiagraphic figure of the heart, the more difficult naturally will be their recognition and correct interpretation. Insomuch as they can only be partly represented numerically, their recognition demands in fact very great experience and skill in technic and an acquaintance with all the factors whose influence on the form of an orthodiagram of the heart we have learned to recognize.

Inasmuch as the determination of the form of the orthodiagram in the question under discussion is given the precedence over the determination of the size, the value of the normal figures heretofore exclusively considered in practice suffers a certain limitation; but it seemed necessary to call attention distinctly to these

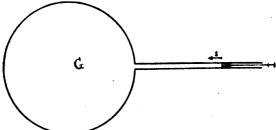


Fig. 10.-Dynamical measurement of pulse-pressure.

disadvantages which a one-sided consideration entails, especially in the hands of inexperienced investigators, who are only too easily induced to form an opinion regarding a heart, simply on the basis of normal figures, and thus to overlook changes which probably enable one to draw much more important conclusions with regard to the pathologic conditions of the heart.

Dynamical Diagnosis of the Pulse. T. F. Christen<sup>8</sup> calls attention to the fact that many clinicians believe

<sup>(8)</sup> Edinburgh Med. Jour., September, 1912.

that the old method of palpating the pulse is still more valuable than the newer and more exact methods of determining blood-pressure and the tracings of the sphygmograph. The reason seems to be that two factors are estimated in this way, although crudely, which are not represented in the findings of the instruments named.

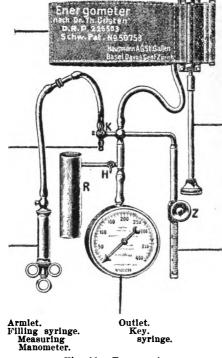
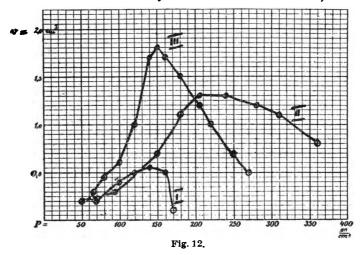


Fig. 11.-Energometer.

These two factors are the plenitude of the pulse beat and the intensity. The plenitude is the systolic increase of volume of a given artery and the intensity is the mechanical energy required to bring this about. There remains to be measured the obstacle which produces the increase of volume in the artery, as is done by the palpating finger. For this purpose the pneumatic armlet may be used and the amount of this obstacle can be exactly measured by the presence of the contained air. If we suppose an incompressible volume represented by V to be introduced into a closed vessel, the pressure within the vessel will be increased, and representing the energy required to produce this increase of pressure by E and the pressure by P the following equation can be derived E—PV. Therefore if any small incompressible volume V is brought into a closed, gas-containing vessel whose walls may be elastic or non-elastic, and

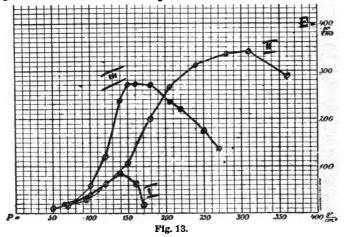


whose pressure is P, the energy required hereto is equal to the product of the pressure and the incompressible volume. (Figure 10.)

The volume of the artery which causes the increase of pressure is not directly measurable, but it can be determined by introducing under the same conditions an equal volume, which is necessary to cause the same increase of pressure. Thus by the use of a graduated syringe communicating with the air-space of the armlet and pushing the piston in sufficiently to produce the same amount of increase of pressure as is produced by

the pulse, the plenitude of the pulse beat and the energy necessary to produce it may be measured. This apparatus is known as an energometer. It is provided with a metallic manometer of great delicacy and small inertia, which responds readily to the changes of pressure in the cuff. The pressure is taken where the oscillations of the gauge are the greatest.

The plenitude is measured as follows: If the pulse produces an oscillation of pressure between 149 and 155,



the screw which actuates the piston of the syringe is turned and continues to the point at which the oscillation takes place between 155 and a higher pressure. The only thing to be observed is to find out the point where the upper limit of the oscillation, 155, has become its lower limit. We then know that the pushing in of the piston has produced the same increase of pressure within the closed gas-room of the armlet as did formerly the pulse. The valume is then read from the scale of the syringe, and it determines the plenitude of the pulse. From the plenitude the intensity is computed by the formula. (Figure 11.)

The results of the energometer are independent of the elasticity of the tissues and also of the gas-volume in the

armlet. By plotting out the pressures as abscissæ and the corresponding volumes as ordinates we get a series of points which we may join by a curve. These curves show different forms which are characteristic for different pathologic conditions. Thus energometry opens an entirely new field of clinical investigation based on exact mathematical construction. (Figures 12 and 13.)

Relative Value of Physical and Functional Signs. Schmoll<sup>o</sup> calls attention to the tendency to rely too much on physical signs, especially in detecting the earlier stages of failing circulation. He calls attention to the fact that the apparent size of the heart may be influenced by a number of circumstances which may cause a normal heart to appear enlarged. In such cases the mistake is likely to be committed of assuming the presence of serious heart disease when that organ is entirely Thus pressure of a mediastinal tumor, distention of the stomach, and even the enlargement of the abdomen in pregnancy, may cause not only a functional disturbance of the heart's action but an apparent change in size, which might be held indicative of actual organic disease. Thus we see that any attempt to found the differential diagnosis between functional and beginning organic heart disease on a questionable enlargement is pseudo-scientific. Since the methods at our disposal are inaccurate and do not furnish sufficient data in themselves, we must welcome two more factors which can be of great service in reaching a conclusion—the questions of function and of probable etiology.

Examination of the circulatory conditions throughout the body may indicate signs of failure long before the most careful method can detect anything wrong with the central organ. Such are enlargement of the liver, a gain in weight due to interstitial edema and pulmonary symptoms. A factor of the greatest importance and one that must not be overlooked in the differentiation between functional and organic heart trouble, especially in patients over forty years of age, is the presence of arteriosclerotic changes in the aorta and large vessels. As aids in making our decision may be mentioned the

<sup>(9)</sup> Jour. Amer. Med. Assoc.

ringing, high-pitched aortic second sound, unequal elevation of the subclavian arteries, pupillary changes and the characteristic radiogram. As etiologic factors may be mentioned rheumatism, syphilis and enlargement of the thyroid.

For purposes of treatment, heart diseases may be divided into two groups; the first includes all cases of rheumatic origin and the other is characterized by a primary progressive disease of the arteries. The common signs of failure in the first group are: râles at the base of the lung posteriorly, a gain in weight, enlargement of the liver and edema of the ankles. It is in these cases that digitalis earns its great popularity, and we must judge of the rate of improvement by the subsidence of the symptoms just described and not by any diminution in the size of the heart. In the author's experience, the finding of narrowed heart dulness is generally the result of autosuggestion. The disappearance of edema, an increase in the total amount of urine, and a slowing of the heart-rate are much more reliable gauges of the heart's condition.

The arterial degenerations of the second group often lead to conditions closely resembling those of the first group. Here, too, there may be a leaking aortic or mitral valve with dilatation and hypertrophy of either ventricle, but the treatment must be along different lines. Not only is the heart diseased in these cases, but there is a deterioration of almost every vital organ following years of deficient blood-supply. This is particularly true of the kidney and the symptoms in these cases are frequently those of slight uremia. The arterial origin of the apparent heart disease is betrayed by the high blood-pressure, headache, gastro-intestinal symptoms and particularly attacks of nocturnal asthma.

Digitalis will only aggravate such cases, and treatment must be directed toward relieving the kidney. Most important then is a salt-free, low protein diet, supplemented by the free use of diuretics.

Subclavian Beating. In patients affected with certain diseases of the arteries and heart the supraclavicular hollows are the seat of arterial pulsation, which in many

cases shows the form of the elevations described for the first time by A. Faure in 1874. C. Trünecek<sup>1</sup> has given careful study to this peculiarity in a large number of patients, and believes that he has found its origin and pathologic significance. In the normal man no pulsations are felt in this region, because the subclavian artery lies too deep to disturb the surface. On the other hand, a visible pulsation of all the superficial arteries, including the subclavian, is found regularly in cases of aortic insufficiency, but this sign is of no importance for the present study. In other cases, however, in which there is no valvular disease, the supraclavicular hollows are the seat of visible or palpable pulsations. On applying the finger behind the clavicle one perceives that these pulsations have the form of a shock, which takes place very brusquely, and in very pronounced cases even lifts the finger lightly applied. This shock Trünecek attributes to the passage of the blood from a part of the vessel whose walls are rigid to a part which is elastic. In this way he concludes that the shock in the subclavian is caused by a sclerosis of the aorta. In certain cases the sign is unilateral on the right side and indicates the sclerotic affection of the ascending aorta. When felt on both sides it must be referred to a sclerosis of the entire arch of the aorta. A similar sign may be demonstrated in the other peripheral arteries, especially in the femorals, which are easily accessible to examination at their exits from the abdomen.

To conclude, the sclerotic shock of the peripheral arteries in general, and that of the subclavians in particular, is a sign easy to recognize. For its determination there is no need of apparatus nor of special clinical experience; moreover, it offers the advantage that in order to find it it is not necessary to subject to great fatigue patients, who most frequently are already much debilitated by disease. The sclerotic shock of the subclavians is therefore a sign which furnishes sure and definite indications of the anatomic condition of different parts of the thoracic aorta, an organ inaccessible to direct exploration.

<sup>(1)</sup> Semaine Méd., Dec. 20, 1911.

## TREATMENT.

Prevention of Asystole. M. A. Mayor<sup>2</sup> emphasizes the importance of postponing as far as can be done by preventive treatment the subsequent attacks of asystole. Thus the period is delayed when organic alterations have reached such an importance that the asystole becomes intractable, and at the same time, as is shown later, one has some chance of rendering this utimate crisis shorter and less painful than is usual. For this purpose the author, in addition to the ordinary dietetic and hygienic regulations, advises the administration at intervals of a week of small doses of digitalis corresponding to 0.1 gm. (1½ gr.) of powdered digitalis, repeated for two or three days. He proposes to begin this preventive medication as soon as there are any symptoms of failing heart action, or, indeed, before such symptoms have appeared. if there are any conditions which make it probable that a lack of compensation will presently occur.

In emphysematous patients or those affected with chronic bronchitis there comes a time when the attacks of pulmonary congestion recur more frequently or where the exacerbations of the bronchitis show an abnormal obstinacy to treatment. One would not be justified in speaking here of hyposystole, and yet these symptoms indicate already a manifest weakening of the heart. If from this time the chronic discontinuous treatment by small doses of digitalis is instituted, this aggravation in the habitual condition of the patient will recede and the broncho-pulmonary attacks will become less frequent. In patients affected with a chronic nephritis, although they have followed an appropriate hygiene for a long time, attacks of dyspnea may become more frequent or may come on under the influence of insignificant causes. In such a case, however, the same treatment will postpone for a long time the threatening asystole.

The author brings clinical and experimental evidence to explain this action of digitalis, and continues: "It goes without saying that this favorable action of digitalis cannot arrest the evolution of a progressive cardiopathy, but this progress being increased by the

<sup>(2)</sup> Presse Méd., Jan. 27, 1912.

pathologic storms which are represented by successive crises of asystole, everything which will postpone these crises, or which will render them less frequent, will contribute to slowing the fatal course of the disease. Now this is exactly what can be secured by the preventive treatment of asystole by minute doses of digitalis,—a treatment which is no longer reserved for the recurring condition of hyposystole, but which should be prescribed with a deliberate purpose to all cardiopaths whose heart has once given way, and should be methodically continued during the entire life of the patient without interruptions other than those fixed by the form of treatment that has been adopted. However, to the rule that has just been established exception may be made in one circumstance, which is, however, very rarely encountered. This is represented by asystoles supervening suddenly in the course of valvular diseases or under the influence of an excessive effort which is not likely to be repeated. In such a case one may temporize and wait for a recurrence."

In conclusion the author believes from an experience of several years that digitalis in a proper dose ought in certain cases to be administered to patients with heart disease in a condition of compensation. It is not necessary to postpone intervention until repeated attacks of asystole have led to a recurring condition of hyposystole. As soon as the heart has once yielded, the preventive treatment of the second attack ought to be established by means of the methodical and regular administration of small doses of digitalis. In general one should begin by a chronic discontinuous treatment: then suspend it for a time, and, guided by circumstances, gradually shorten the pauses until he passes to the continuous treatment. Finally there are cases where the discontinuous preventive treatment may be instituted in advance of any failure of compensation, because in the course of certain diseases which predispose to it this failure seems likely to occur. In a similar manner there are conditions of heart disease which require from the very first a treatment by minute doses administered day after day.

Nauheim Treatment. In a résumé of the effect of the Nauheim treatment in cardiac disease, J. M. Swan<sup>3</sup> states that the carbonated brine baths in suitable cases do good, on account of the evening up of the circulation by the resulting dilatation of the cutaneous vessels, thereby relieving the peripheral resistance to the work of the heart. The resistance exercises do good by strengthening a weak muscle through exercise of that muscle.

The treatment is indicated in cases of cardiac weakness following the acute infections, such as typhoid fever and influenza; in cases of cardiac weakness accompanying debilitating and wasting diseases, such as diabetes mellitus and pernicious anemia; in cases of cardiac weakness following severe hemorrhages and the secondary anemias; in cases of cardiac weakness following surgical operations; in the early cases of failure of compensation in chronic valvulitis; in cases of simple dilatation; in cases of cardiac neurosis and in cases of tachycardia and arrhythmia. In the last three cases the treatment must not be expected to be followed by as uniformly favorable results as in the others.

The treatment is contra-indicated in cases of nephritis, aneurism, advanced arteriosclerosis and severe cases of broken compensation with edema. In early cases of fibroid myocarditis, with high blood-pressure and beginning arteriosclerosis, the baths, if given at all, should be given with great caution. Swan is inclined to believe that they had best not be given, but he is open to conviction on this point.

- L. B. Bishop<sup>4</sup> summarizes the features of the Nauheim treatment aside from the effect of the water:
- 1. The removal of all drugs, stimulants and tobacco from the patient, these drugs only to be restored and put back in the patient's treatment as they are actually needed.
- 2. The sleep and rest induced by the surroundings and by the removal of caffeine from the coffee, and often

<sup>(3)</sup> N. Y. Med. Jour., Oct. 7, 1911.
(4) N. Y. Med. Jour., Jan. 6, 1912.

by the removal of other drugs which have been keeping the patient awake. Heart stimulants are also brain stimulants: Caffeine stimulates the heart and keeps the brain awake; strychnine irritates the brain; and even digitalis in a great many cases has its cerebral symptoms.

3. Simple, plain food, slowly eaten in divided portions so that the appetite is satisfied without the patient's gorging himself.

4. Outdoor exercise taken in a pleasant way so that

the patient is hardly conscious of it.

5. The spirit of hopefulness, from which the patient receives great benefit, and the removal of all depressing influences in the way of the contemplation of patients

who are not going to get well.

The baths consist essentially of a strong brine bath, with a considerable amount of calcium chlorid, and a certain amount of carbonic acid gas. In America persons imitate the carbonic acid gas baths, and really add more carbonic acid gas than in the baths at Nauheim, and forget all about the salt. It takes a good many pounds of salt to make a bathtub full of water the same strength as the natural bath at Nauheim. In fact, it is almost as well to leave out the carbonic acid gas and have the salt as to do without the brine.

He recommends that an institution embodying these

features be established in America.

Cane-Sugar. A. H. Carter<sup>5</sup> reports a case of cardiac failure treated by cane-sugar with marked improvement. The patient took from two to three ounces daily. Her improvement began to be obvious after the middle of the second week, and by the end of the fifth week it was remarkable. The pulse was steady and stronger, and normally 72 to 78; it was not abnormally altered by exertion, and quickly resumed its normal rate after rest. The first mitral sound was stronger, and altogether of better quality. She could walk nearly three miles without a rest or undue fatigue, and a very short rest completely restored her. Her mental vigor was quite reestablished, and her feeling of well-being and "fitness"

<sup>(5)</sup> Brit. Med. Jour., Nov. 25, 1911.

after the months of weariness and lassitude was really extraordinary.

H. Dingle reports a case of cardiac failure treated by cane-sugar. The patient, a plumber, aged 28, suffered from great shortness of breath, and a swelling of his abdomen, which had come on after severe exertion. This was evidently a case of failing heart, due to damage of the mitral valve from overexertion. He was treated with all the various cardiac drugs, in variable doses, with absolute rest and suitable diet. He at times showed signs of improvement, but it was never lasting, and he went from bad to worse. He was repeatedly tapped. It was deemed a hopeless case until five ounces of cane-sugar daily were added to his diet. He then began to improve.

Epinephrin in Circulatory Weakness. A. Hoffmann divides circulatory failure into cardiac and vascular. the vascular being usually due to vasomotor weakness or paralysis, or in certain cases to psychic influences. Corresponding to these two forms of circulatory failure, the therapeutic measures must be adapted either to the heart or to the vessels. The author recommends the use of camphor, digalen and the intravenous injection of strophanthin. When strophanthin is given the best preparation is the strophanthin (Thoms), which should be given in doses of .001 gm., or at the most .0015 gm. A second dose should not be given for several days, and it is not usually advisable to give strophanthin while the patient is under the influence of digitalis. The two drugs may produce a cumulative effect which has sometimes resulted fatally.

When the cause of the circulatory failure lies in the weakness of the vessels the important remedies are the vasomotor tonics or stimulants. Of these one of the most important is caffeine. Next comes epinephrin and the active principle of the hypophysis,—pituitrin. The original method of using adrenalin was exclusively intravenous, but this application involves great dangers. The stimulant action of an injection of .001 to .0005 gm.

<sup>(6)</sup> Brit. Med. Jour., Jan. 13, 1912.
(7) Deutsche med. Wochenschr., Oct. 3, 1912.

of epinephrin on the circulation is more marked than can be caused by almost any other remedy. A contraction of the arteries, formerly exhausted, sets in, and the blood-pressure rises enormously. The result, however, is that the heart, which previously was scarcely able to fill the relaxed blood-vessel with a sufficient amount of blood, is suddenly obliged to act against a much greater resistance, and while it previously could empty itself with due facility, it is suddenly compelled to employ all its reserve force in order to expel the blood. If the heart is healthy and capable of activity it can overcome this shock which the stimulating action of epinephrin on the heart produces. On the other hand, it may fail completely.

The vasoconstrictor action of epinephrin introduced intravenously soon disappears and there occurs a fall of pressure in consequence of the relaxation of the vessels, which frequently sinks below the original value. The unfavorable conditions again return and can be removed only by repeated injection. The intravenous use of epinephrin should therefore be restricted to cases in which a marked insufficiency of the circulation occurs suddenly in a patient whose heart is apparently healthy and where we are in a position to remove the injurious influence which has brought about the insufficiency immediately after an injection. Such might be the case during the administration of anesthesia. In infectious diseases the conditions are quite different. It is rare that one has to deal with a disturbance which occurs suddenly and is only temporary. The poisons which gain entrance to the circulation continue their action after the occurrence of the circulatory failure. The subcutaneous injection of epinephrin is much to be preferred in such cases.

The Use of Digitalis and Strophanthus. In a clinical lecture on the treatment of heart diseases, Eichhorsts calls attention to the frequency with which the disabled heart of a laboring man, which seems utterly unable to carry on the circulation longer, will recover strength from simple rest in bed. Second in importance to this

<sup>(8)</sup> Correspondenz-Bl. f. Schweiz. Aerzte, October, 1911.

measure he estimates a sufficient diet, which can usually be obtained by the administration of milk. This, however, is not efficient in certain cases on account of the large amount of fluid which must be introduced to obtain a sufficient amount of nourishment, as indicated by the requisite number of calories. In some cases this amount of liquid becomes an extra burden upon the heart, which may be injurious. In such cases care must be taken to increase the caloric value of the food without increasing the amount of liquid.

Among the heart tonics Eichhorst mentions a considerable number as demonstrably of value as shown by animal experiments, but concludes that clinical experience indicates that only two are reliable, the preparations of strophanthus and those of digitalis. While in the opinion of the author strophanthus deserves the first place, according to experimental researches, their relations must be reversed in practice. Digitalis is the medicament of first choice. Of the preparations of digitalis, Eichhorst gives the preference to the powdered leaves and to the digalen of Cloetta. He notes the many circumstances which cause a variation in the strength of digitalis, among which are the locality from which it is obtained, the age of the drug, etc. Eichhorst notes that while care must be exercised not to push the drug beyond the point at which the pulse becomes notably slow, the danger of cumulative action is not so great as was formerly supposed. He does not recognize an objection to the giving of digitalis in aortic disease, but claims that since the danger is from the weakness of the heart muscle, a heart tonic should be available in all forms of heart disease in which muscle weakness is the principal cause of the symptoms.

Psychic Treatment. M. Herz<sup>o</sup> classifies the ways in which the mind can influence the heart as follows: Hypochondriacs, having learned that the heart is affected, enlarge the picture by help of their intelligence, and associate with the circulation all the symptoms which they feel in every part of the body. Even uneducated men soon learn the meaning of the peripheral circulation

<sup>(9)</sup> Wien. med. Wochenschr., Jan. 20, 1912.

and the effects of the circulation on the different organs, and build up a systematized delusion around the idea that their heart is diseased.

A second way in which the mind acts on the heart is through the emotions. A person who is frightened soon feels pain in the region of the heart and from the memory of the fright the associated pain returns. It may also happen that the association of fright with the pain may become so close that pain aroused by other causes will give rise to the circulatory phenomena and the mental feeling of fright.

A third form of psychic influence on the heart is, in the opinion of Herz, of still more importance. He asserts that probably the greater part of the cases of coronary sclerosis which arise on other than a luetic basis are the result of psychic influences. In reply to a circular of inquiry, Herz found that practical physicians attributed about half of the cases of coronary sclerosis to physical overwork, and the other moiety to mental causes, such as anxiety and care. What connection can such psychic factors have with physical overwork that they should produce the same effect on the coronary arteries? Herz finds the explanation in the following reasoning: The feeling of overexertion or of fatigue is essentially a psychic one depending, not so much on the amount of work done, as on the way in which it is done and the impression made on the general nervous system. if the arm be stretched out in an uncomfortable position. a feeling of fatigue soon arises, although no great amount of effort has been made.

The result of the psychic impression made is a rise of blood-pressure generally throughout the body, with a dilatation of the vessels in the affected muscle so that this is abundantly supplied with blood. It is easy to understand that unusual demands are made on the coronary arteries with every overexertion of body or mind, and thus the arteriosclerosis arises as a disease depending on the overuse of the coronary arteries. It may be taken as an axiom that displeasure is a powerful, injurious agent in its action on the heart. Our most important task is to avoid displeasure. Care must be

taken to avoid occasions which will arouse displeasure in our patients, and every effort must be made to remove it if it is already acting on the mind of the patient. Herz illustrates this principle by the method of prescribing diet and exercise.

In spite of the exact determination of the needed calories, an unpalatable diet will do harm rather than good, if it excites disgust and so affects the heart unfavorably. Milk excites such a distate with some people that this feeling harms the patient more than the nutrition from the milk benefits him.

Care must also be taken not to excite apprehension by the diagnosis and prognosis made. Herz holds that patients should not be told the nature of their ailments, if it is likely to disturb their equanimity. A simple term, which to the physician seems a matter of little moment, is magnified by the imagination of the patient until it occupies his attention to the exclusion of almost all other ideas. Even physicians are much disquieted by the idea of a calcification of their arteries. The relatives of patients should not be told the nature of their malady unless the relative, such as an anxious wife, will not be likely to betray the fact by a melancholy and anxious expression of countenance.

Not only must one not arouse the feeling of displeasure, but every effort should be made to remove it when once established. Moreover, means should be taken to arouse hope and physical buoyancy. For this purpose the author recommends kola. He also recommends alcohol in certain cases.

The methods of physical therapy possess the advantage, in addition to altering the circulation and opening areas to the free passage of the blood, which were closed hitherto, that they arouse a feeling of exhilaration which may last the entire day. Care must be taken in using these agents that displeasure is not aroused. Exercise must be taken in pleasant ways. Health resorts and curative institutions have the advantage of a psychic impression which cannot be obtained at home.

# CARDIAC NEUROSES.

The General Principles of Treatment. Müller de la Fuente<sup>1</sup> discusses the pure neuroses of the heart, which must be carefully distinguished from organic heart disease, while care must be taken not to attribute them without good grounds to a general neurasthenia. These cases need careful treatment because the ordinary remedies for disease of the heart are likely to do harm rather than good. He recommends particularly a trial of iodin in the form of iodglidin. The chief remedies are, however, the physical methods. In this respect he earnestly warns against an uncritical application. methods which are used with the best results in neurasthenic complaints may not only completely fail, but even do harm. Such are, for instance, cold bathing and Generally cold should be applied only in the douches. form of an icebag or a wet sponge used in a symptomatic manner. Douches, even warm or lukewarm, should, at least in the beginning of the treatment, be unconditionally avoided. As a general rule, the first principle may here be stated as non noscere. One should proceed with extreme caution, as, on account of the varying character of the patients, one can never predict with certainty what will do harm and what will not. A treatment may be begun with lukewarm baths or packs at a temperature of 34°-35° C. (95.2°-97° F.), being careful not to overdo it. The author recommends a duration of from three to five minutes every second day as an initial dose. The length and frequency may be gradually increased in proportion to the individual reaction.

The author would not entirely reject the carbon dioxid baths, which he regards as indicated when the simple bath is of insufficient service but has always been well borne. Even in these cases, however, they should be applied with the greatest caution in the beginning. An air-douche of varying temperature has given good service. He directs the current of air against the apex of the heart, and begins with cool air for one minute and follows it by a douche of warm air for the same length

<sup>(1)</sup> Therap. Monatsh., July, 1912.

of time, then again cold air, and so alternately for a period of, at first, six, and later, ten, minutes. He increases the temperature of the warm air, but does not

change that of the cool air.

With these relatively simple remedies he has succeeded in securing a cure or permanent benefit in a number of cases of pure neuroses of the heart, of medium or great severity. Patience and perseverance are required and psychic treatment is an important factor. Naturally, an appropriate diet must be given, and especially the use of coffee must be unconditionally forbidden.

Only when neuroses of the heart accompany or are symptoms of another disease are the remedies for the latter appropriate. As these often act unfavorably on pure neuroses of the heart, both a careful investigation and an exact determination of the diagnosis are absolutely

necessary.

Phrenocardia. The cardiac neuroses are systematically treated in a course of lectures by M. Herz,<sup>2</sup> who introduces the condition which he denominates phrenocardia as one of the chief nervous affections affecting the action of the heart. Neuroses of the heart present few objective signs, and these are not characteristic. Herz's investigations have led him to the following conclusions as to differential diagnosis:

1. In the presence of complaints of the heart the occurrence of a low blood-pressure when an insufficiency of the heart muscle can be excluded, is indicative in almost all cases of a neurosis.

2. Extrasystoles with low blood-pressure are found

as a rule only in neuroses.

3. If the blood-pressure is low, a systolic murmur, not of arterial origin, probably does not have its origin in a compensated mitral insufficiency.

4. In phrenocardia, the heart neuroses characterized by low blood-pressure are more common in the female.

5. In the neuroses characterized by low tone, the dominant symptoms are the painful sensations in the region of the heart; in nervous bradycardia, palpitation, and in hypnotic bradycardia, general physical weakness is

<sup>(2)</sup> Klin.-Ther. Wochenschr., Feb. 19, 1912.

characteristic. At least in bradycardia hypotonica there exists a genuine nervous heart weakness, sometimes

accompanied by albuminuria and edema.

The term phrenocardia is derived from phren, diaphragm, and kardia, heart, and is used because of the combination of symptoms referable to the diaphragm and the heart. The neurosis is characterized by three principal symptoms: a peculiar disturbance of the breathing, pain in the heart and palpitation. The disturbance of breathing is occasioned by the low position of the diaphragm, which is held constantly by a tonic spasm in a condition of partial contraction, so that the patients feel as if they could not draw a breath, although there is no acceleration of the respiration, but more or less frequent sighing inspirations and forcible expirations. The diaphragm is lower on the left side.

The pain referred to the heart is of varying severity and is felt below and generally to the left of the apex. It is usually complained of as an ache or darting pain, and is frequently likened to lumbago or neuralgia. The pains always disturb the respiration, which is carried on with great caution while the pain continues. Palpitation is seldom very prominent, but consists in a sensation of rapid and weak heart action or of other uncomfortable sensations about the heart. This symptom is not aggravated by physical exertion, but anything which necessitates close attention, such as movements requiring steadiness of the muscle without great strength, will bring on or aggravate the feeling. The author uses a test which he calls a self-restraint test. This consists in a movement of the right arm carried out slowly and steadily without resistance, a movement which would occasion scarcely a noticeable effect on the normal heart, but in this neurosis often brings on a greatly quickened action of the heart. This self-restraint test produces its effect not through the slight demands on the muscle, but by the strenuous demand which its makes on the attention.

These cases are likely to exhibit other symptoms which accompany but form no essential part of the symptomcomplex designated by the term phrenocardia. Such symptoms are the expression of a general neurasthenia with which the phrenocardia is associated, but from which it may be distinguished as a distinct entity which can exist by itself without other manifestations of neurasthenia.

Especially in the evening or at bedtime the attacks may sometimes resemble attacks of angina pectoris. While the condition seems somewhat alarming, a glance is usually sufficient to distinguish it from angina. In hysterical patients the symptoms are greatly exaggerated.

As to the causation, occurrence in members of the same family is common, although a distinct heredity cannot be established. It frequently affects husband and wife, especially when it is occasioned by abnormal sexual practices in which the pair have mutually indulged. Neurasthenia and hysteria are powerful predisposing influences. Sexual practices which lead to unsatisfied desire, or a psychic shock connected with the sexual life, are efficient causes.

Neurasthenia and hypochondria of the heart are neuroses which should not be confounded. The symptoms of neurasthenia are referred to the region of the heart, and consist either in abnormal sensibility of the cardiac nerves, or in an unusual demand on the part of the nerves controlling the heart. Hypochondriasis may connect sensations in various parts of the body with the action of the heart. It must be regarded as a psychosis rather than a neurosis.

Hypotonic bradycardia is a neurosis characterized by a reduction of the blood-pressure and a slowing of the heart action. The most prominent symptom is a feeling of general weakness and inability to work. A special symptom is a peculiar feeling of weakness in the knees which makes walking and standing difficult. On forced movements of the body shortness of breath is caused very readily. Very often there are distressing feelings of dizziness, nausea, a feeling of oppression in the chest, and insomnia. The patients are generally well nourished, and look pale.

Attacks occur in which the symptoms are exaggerated; the patients lie on a couch with closed eyes, and are often covered with sweat, the pulse being in some cases markedly retarded, in others much accelerated, indicating a disturbance in the innervation of the heart by the vagus. In addition to short attacks, this hypotonic bradycardia may show itself for long periods and may exhibit other symptoms which resemble those described by Eppinger as vagatonia. The result of a low pressure and a slowing of the pulse is to produce a deficient heart action, which causes a deficient supply of blood to the peripheral organs.

#### PAROXYSMAL TACHYCARDIA.

The Anginous Form. L. Gallavardin<sup>3</sup> calls attention to the fact that while paroxysmal tachycardia is not commonly accompanied by much pain, there are certain cases in which the pain is so considerable as to resemble an attack of angina pectoris. He reports a case of this character and calls attention to others which have been noted in the literature. In discussing the nature of this form he raises the question whether it is to be explained as a tachycardia arising in the course of an attack of angina pectoris or whether the paroxysmal tachycardia is the cause of the painful symptoms. He inclines to the view that the pains are due to a distention of the heart occurring in the course of an attack of paroxysmal tachycardia. For this view he assigns two reasons, depending on facts observed in his patient: first, the relatively late development and progressive character of the anginal pains in the course of the attack; second, their complete absence in the course of an attack which did not last longer than fifteen to twenty minutes, and without doubt was insufficient to provoke a marked cardiac dilatation.

The Venous Pulse and Rhythm. Gallavardin<sup>4</sup> also discusses the venous pulse and cardiac rhythm in a case of paroxysmal tachycardia, and reaches the following conclusion:

1. The form of venous pulse most commonly met in attacks of paroxysmal tachycardia is the ventricular venous pulse, which may be explained either as the sign of a paralysis or fibrillation of the auricle, or as the expression of the simultaneous contraction of the two

<sup>(3)</sup> Lyon Méd., Feb. 11, 1912.
(4) Lyon Méd., Feb. 11, 1912.

cavities, auricular and ventricular (nodal rhythm of Mackenzie).

2. It is possible that certain forms of the venous pulse, apparently auricular, which are observed in the case of some attacks, are in reality only instances of the pseudo-auricular venous pulse in which the presystolic venous wave does not correspond to the contraction, but simply to the stasis of the auricle, the type of cardiac revolution remaining the same as in the preceding form.

3. The question still remains as to whether there exist attacks of paroxysmal tachycardia with a true auricular venous pulse, an index of a cardiac contraction no longer

ventricular or nodal, but auriculo-ventricular.

Treatment. M. Herz<sup>5</sup> regards paroxysmal tachycardia as the most important cardiac neurosis. The difficulty of treatment of this condition is indicated by the number of remedies proposed and the uncertain action of them in different individuals and at different times. A measure which is effective in cutting short the paroxysm in one case will prove without avail in another, and a remedy which has succeeded at one time may fail in the next attack in the same individual. Sometimes faradic or galvanic electricity or mechanical pressure on the vagus are useful; cold applications to the neck, the icebag or a spray of ether or ethyl chlorid may be tried. Some patients have learned special maneuvers which will cut short the paroxysm. The various medicinal remedies recommended are not more successful. The following prescriptions are given by Herz without an enthusiastic recommendation of any one of them:

Ŗ	Tinct. Valerian, Extract. et pulv. rad. rhei q. s. ut ft. pi	0.9 1 No. XXX
8.	3 pills a day.	
Ŗ	Argenti nitratis Argillæ Aq. dest. q. s. ut. ft. pilulæ No. XXX	0.3 3.0
S.	3 pills a day.	
Ŗ	Tinct. veratri	1.0 180.0
	Syrupi aurantii	20.0
M	S. A tablesnoonful three times a day.	

The most important task of the physician is to combat the attack by suitable dietetic and physical treatment in

<sup>(5)</sup> Klin.-Ther, Wochenschr., Mar. 4, 1912,

the interval. Everything that is likely to excite the heart should be avoided, such as emotional excitement, tea, coffee or tobacco. Alcohol appears to be relatively harmless in this connection. If there is reason to believe that the attacks are due to the condition of some other organ. proper measures should be directed to the exciting cause.

Hypochondria directed to the heart is essentially a psychosis which offers little prospect of successful treatment. It is as difficult to convince patients of the harmlessness of their cardiac symptoms as to reason a paranoiac out of his delusions. Even physicians, in spite of assurances to the contrary, will persist in attributing all sorts of inconsequential sensations to the condition of their heart.

Neurasthenia of the heart presents an agreeable contrast to the two preceding neuroses in that it is quite amenable to treatment. The principles of treatment are the same as those for neuroses in general. It must be understood that in spite of the apparent debility of the heart the ordinary heart tonics are likely to do harm rather than good. The bromids are of especial service. If there are indications of a participation of the vessels in the production of the symptom-complex, quinine preparations may render good service. Hydrotherapy is of value, but the measures adopted should not be directed especially to the heart. Carbon dioxid baths, which are associated with organic disease of the heart in the minds of many patients, are liable to do harm. Gymnastics may be employed with benefit. Bradycardia associated with a stimulation of the vagus is best met by the use of atropine. On the other hand, in case of hypotonic bradycardia, a general stimulation of the whole system with a general tonic regimen is appropriate.

Cases of phrenocardia require, first, an inquiry into the causal circumstances, especially the sexual life. If the disease arises, as in some cases, from attempts to prevent conception, the injurious nature of such practices should be explained to the patient and she should be persuaded to abandon them. For the attack itself, suggestion is the most important remedy. A few assuring words or a firm command will often bring the exciting scene to an end. One should not humiliate the patient before friends but endeavor to see her alone and gain her confidence. Hot applications may be made or manual vibration of the region of the heart may be employed; but injections of morphine or camphor or the use of digitalis should be avoided.

Hydrotherapeutic measures of a sedative nature are almost indispensable. Psychic treatment is of extreme importance in neuroses, and Herz emphasizes their importance in organic diseases of the heart. The patient with a sick heart can not be treated like a laboratory animal or an inorganic machine. Physical therapy, gymnastics, hydrotherapy, hill-climbing, etc., may be combined with the other measures and be made to convey the suggestion of improvement which forms a large part of the psychic treatment.

As to diet, the mistake of too great restriction is made oftener than that of too great indulgence. Tobacco, coffee, etc., should not be forbidden too peremptorily, but the allowance of a minimum of such substances is likely to be a comfort and will do no harm. Herz regards

alcohol as a remedy.

### ARRHYTHMIA.

Auricular Fibrillation. This form of heart disease has received special attention of late and is the subject of several important articles, including the Schorstein lectures by J. Mackenzie, an article by J. G. Immanuel and one by L. Gallavardin and A. Dumas. The condition has long been known, but not well understood nor clearly defined as a clinical entity. It can be recognized by the ordinary methods of clinical examination, but its nature has been greatly elucidated by examinations made by the polygraph and the electrocardiograph. From the results of these examinations the condition appears to consist of a lack of order in the contractions of the parts of the auricle so that, while individual fibers or groups of fibers are frequently contracting, the auricle as a whole does not contract, and hence fails to produce a

<sup>(6)</sup> Brit. Med. Jour., Oct. 14, 1911. (7) Brit. Med. Jour., Mar. 9, 1912. (8) Lyons Méd., July 7 and 14, 1912.

regular expulsion of the blood into the ventricle. Moreover, the impulses are not conducted to the ventricle with sufficient force to produce regular contractions of the ventricle.

It was formerly believed by Mackenzie that in this condition the ventricle took on a rhythm of its own. originating in the bundle of His, but the contractions of the ventricle are not rhythmic and are seldom as slow as those which arise from the independent action of the ventricle. It is probable, therefore, that the contractions of the ventricle are the results of those impulses which reach it with sufficient force to excite its contraction and which are communicated at such intervals that the rhythm of the ventricle becomes irregular. In consequence of this irregularity the name pulsus irregularis perpetuus has been given to this condition, but Mackenzie has observed cases in which the rhythm of the ventricle is regular. In these cases he believes that a heart block has occurred, so that the pulsations of the ventricle have become independent and have assumed the peculiar slow rhythm of the ventricle when acting independently of the auricle.

Auricular fibrillation is a result of the failure of the Keith-Flack node to govern the contraction of the auricle. It results from various influences which bring about a failure of the heart. It is particularly common in cases of mitral stenosis. Mackenzie gives the following account of the conditions inducing auricular fibrillation.

In experiment auricular fibrillation can be produced by electrical stimulation of the auricular wall. In the human heart it is found to arise under a variety of conditions. It is probable that it is produced by altered nutrition of the muscle. The attack may be temporary, passing off after some hours, leaving no evident lesion of the heart. It may appear in the heart in pneumonia, during the attack and during convalescence, with disastrous results in both cases. Digitalis can induce it in predisposed cases. It has been known to occur intermittently in a fatal case of infective endocarditis, and Price has shown its occurrence in a fatal case of diphtheria. Post-mortem examinations in these last two cases showed that marked changes of an inflammatory nature had occurred in the walls of the auricle.

Effort, sometimes slight and sometimes violent, may provoke auricular fibrillation. This occurs most frequently in the middle-aged or elderly. In many cases these attacks, lasting for a short period, are apt to recur with increasing frequency until they become permanent. While they are occurring intermittently they are often easily provoked by effort, though they may not infrequently arise from no apparent cause. Thus, in one man under Mackenzie's care at the Mount Vernon Hospital, the heart would be detected beating irregularly several times a day, the irregular period lasting from half an hour to two hours. This irregularity was due to auricular fibrillation, as shown by records by the polygraph and electrocardiograph. He himself was not conscious of the altered rhythm, nor was there any recognizable cause for the onset.

We are not yet in a position to decide with sufficient accuracy the nature of the changes in the heart wall which favor the occurrence of auricular fibrillation. In the hearts which showed auricular fibrillation during life, there has been found in the auricle and ventricle an increase of fibrous tissue and of nucleated cells in the muscular walls. In most cases there is probably some definite change which predisposes to this condition, and it only needs an adequate stimulus to provoke it. This stimulus may be of a varied kind, for while the onset can frequently be traced to violent bodily effort, it often occurs when there is no excessive effort. At present we can only say that one predisposing condition is certain organic changes in the muscle wall of the auricle.

The condition of the heart in auricular fibrillation is thus described: "The walls of the auricle stand in the diastolic position: systole, either complete or partial, is never accomplished; the wall, as a whole, is stationary, but careful examination of the muscle reveals an extremely active condition, it appears to be alive with movement; rapid, minute, and constant twitchings or

undulatory movements are observed in a multitude of

small areas upon its surface" (Lewis).

When the ventricle passes into fibrillation, the circulation is at once brought to a standstill, and McWilliam has suggested that this is probably the cause of sudden death in the human subject. When the auricles pass into fibrillation, death does not ensue, for the fibrillation cannot pass along the bundle which connects auricle with ventricle.

Pathologic Anatomy. In the opinion of J. D. Heard<sup>9</sup> organic changes in the body of the auricle are factors which seem to be essential to the occurrence of auricular fibrillation. Fibrotic processes have frequently been described, and these may be particularly dense in the region of the pace-maker, as in a case recently studied by G. Draper of the Rockefeller Institute. The pathologic histology of the condition requires further investigation.

Symptomatology. There are practically no symptoms that are peculiar to auricular fibrillation and the patient may be quite unconscious of the irregularity of the pulse. He may be able to perform arduous labor, physical or mental, for many years though the heart remain permanently irregular. The irregularity, however, hampers the heart action and symptoms of dyspnea on exertion, edema, cyanosis, etc., arise sooner or later. The irregularity may be somewhat paroxysmal, and in such cases the patient is usually conscious of the change in rhythm of the heart.

Diagnosis. Character of the Pulse. The symptom¹ by which the clinical observer can most readily recognize this condition is the character of the pulse, the rhythm usually being irregular, and the irregularity of a very disorderly kind. Irregularities, apart from those due to auricular fibrillation, usually have a distinctive character, as the irregularity in the heart of the young, where variations in rate coincide with phases of respiration, as the intermittent pulse, or the irregular heart due to extrasystoles, the irregularity breaking in on an other-

<sup>(9)</sup> Jour. Amer. Med. Assoc., June 8, 1912.
(1) Brit. Med. Jour., Oct. 14, 1911.

wise regular rhythm, unless it occurs alternating with a normal pulse beat. In auricular fibrillation, as a rule, the pauses between the beats are continuously changing, and two succeeding beats are rarely of the same strength, or the pauses between the beats of the same duration.

The evidence of auricular activity obtained in the clinical examination, apart from the inspection of the jugular pulse, is limited to cases of mitral stenosis. In mitral stenosis there may be two murmurs, a presystolic, due to the forcing of blood through the narrow mitral orifice by the auricular contraction and a diastolic murmur occurring just after the second sound. In extreme narrowing of the mitral orifice this murmur may occupy the greater part of the diastolic period, being immediately succeeded by the presystolic murmur.

In cases of auricular fibrillation the presystolic murmur ceases while the diastolic murmur fills up the whole of the space between the second and first heart sounds when the interval is short, but when the interval is long the diastolic murmur does not reach the first sound and

there is a silence before it.

From these considerations we can, in the great majority of cases, conclude that auricular fibrillation is present when there is a diastolic mitral murmur without a presystolic murmur. As a rule the irregular action of the heart is also suggested, but in many cases of mitral stenosis with auricular fibrillation when the patient is under digitalis the heart becomes slow and almost or even quite regular. The fact that the auricle is fibrillating is the explanation of the observation which has puzzled many physicians, viz., that in mitral stenosis a presystolic crescendo murmur may be absent while a diastolic murmur persists. Signs of heart failure may vary from a slight restlessness on exertion to dyspnea of the most severe kind, accompanied by dropsy and en-These symptoms usually come on gradlarged liver. ually, although in some cases the onset of heart failure may be very rapid. In many cases it is accompanied by wasting, the patients sometimes losing a great deal of weight in a few months. Mackenzie has never seen definite attacks of angina pectoris in connection with auricular fibrillation. In quite a number of cases where the patient had angina pectoris, the attacks ceased with the onset of the fibrillation.

**Prognosis.**- According to Immanuel,<sup>2</sup> the prognosis of a case of heart disease with a continuously irregular pulse will be estimated in much the same way as though the pulse were regular. It will depend on the age, occupation and social position of the patient. Broadly speaking it will depend on the amount of work the heart is capable of doing without the production of any symptom of heart failure.

The question is, Should the irregularity be taken into

account in prognosis or may it be ignored?

To this the answer is: The condition of the heart responsible for the irregular pulse does of necessity embarrass the circulation, but the amount of this embarrassment differs within wide limits. Thus, Mackenzie has watched cases for over ten years, and on the other hand, he quotes cases in which death has occurred within a few weeks of the inception of the irregular rhythm.

Fibrillation of the ventricles is quite another matter. It rapidly brings the circulation to a standstill, and is probably the cause of many cases of sudden death. The fact is, the auricles are not indispensable to the circulation of the blood; they are but temporary reservoirs, which accommodate the blood flowing to the heart while the ventricle is in systole. We know that in animals and in human beings alike the auricle may contract synchronously with the ventricle, the contraction of the ventricle may precede that of the auricle, the ventricle may contract at a rate quite different to that of the auricle, and in all cases the circulation goes on unhindered.

According to Mackenzie a most valuable aid in prognosis may be found in observing how the patient responds to treatment. In sudden attacks of severe heart failure, when the heart's rate is over 120 per minute, it will be well to suspend judgment until the reaction to digitalis is found out. Many such cases respond speedily to digitalis, and with the resultant decrease in the

<sup>(2)</sup> Brit. Med. Jour., Mar. 9, 1912.

heart's rate a remarkable degree of recovery may ensue, so that the patients may be able to undertake laborious work so long as the rate is kept down by the digitalis. This would seem to imply that the exhaustion is mainly brought about by the ventricle being stimulated to too great an activity, and that the slowing enables the ventricle to get more rest, and so regain a measure of strength. From this result we can also gather that the ventricular muscle must be fairly healthy, and we can estimate, within certain limits, the amount of healthy muscle by the degree of recovery.

Treatment. Digitalis is of very great value in the treatment of auricular fibrillation, but it must be very carefully supervised. To understand the action of digitalis it is necessary to appreciate the manner in which heart failure progresses in cases of auricular fibrillation, and the way it is controlled by digitalis. It may be taken for granted that when a patient with auricular fibrillation has a pulse-rate, or, to be more accurate. a ventricular rate, of 90 beats per minute and over, he will in course of time gradually lose strength, his heart will become more feeble, and evidences of heart failure will gradually supervene. This process may be very gradual, but it is very sure. On the other hand, heart failure may set in rapidly, more especially when the heart's rate rises to 120 and 140 and over. The severity of the failure, however it is brought about, compels the patient to seek rest, and we generally find such patients in bed, sitting up and breathing in a labored fashion, with considerable distress, the heart usually dilated and the face of a bluish tinge, and possibly with dropsy and pulsation of the liver. In all such cases the prompt administration of digitalis is urgently called for, and, if given in sufficient doses, relief may be obtained in a few days, the relief being accompanied by a remarkable slowing of the pulse-rate. When this is accomplished, the digitalis should be stopped for a few days, and resumed in small doses when the rate begins to increase. The rate of the pulse should be watched, and the quantity sought for which keeps the heart under 70 beats per minute. It is seldom advisable to keep the rate under 50 beats per minute, although in some cases the patient feels fittest when it is at a rate of about 50 beats per minute. In this we must be guided by the patient's sensations and the manner in which he responds to effort.

Even when patients suffer from only a moderate degree of heart failure, and are able to go about, it is well to place them under the influence of this drug if the pulse-rate is over 90 beats per minute, and in some cases if it is over 80 per minute.

In all cases where the pulse has been sufficiently reduced in rate Mackenzie finds out the quantity of the drug necessary to keep the heart at the rate at which it can perform its work with the greatest efficiency, which is determined largely by the patient's sensations. Once the patient understands the meaning of these sensations, he is usually quick to perceive what digitalis does for him, and its administration can usually be left quite safely in his hands. The best and most assured way in cases of marked failure is steadily to push the drug. whichever form be employed, until a reaction observed. If the digitalis is effective on the heart, as a rule a marked slowing of the pulse is found at the same time or even before any digestive disturbances arise. The drug is then stopped for a few days and if the pulse shows signs of increasing in rate half doses of the drug should be given and the dose increased or diminished according to the manner in which it affects the pulse-Mackenzie finds the tincture a very effective preparation, and usually begins with one dram per day, in doses of fifteen to twenty minims, in cases where the failure is marked. Strophanthin or squills may be substituted in some cases for digitalis, but are not usually effective in cases where digitalis has failed.

Venous Pulse and Pulsus Alternans. T. Griffith<sup>8</sup> discusses some problems springing from the investigation of the venous pulse. Some of these problems may be capable of solution by the electrocardigraph, but as this instrument is not yet in common use he considers them without reference to this method.

<sup>(3)</sup> Brit. Med. Jour., Oct. 12, 1912,

It is not the case that the summit of the ventricular wave always coincides exactly with the aortic notch of the radial; sometimes it precedes it or follows it by a minute fraction of a second. This may be due to the varying amount of blood in the right auricle and the pressure under which it is at the moment of the beginning of the ventricular diastole. Clearly, also, it must depend upon the length of the post-sphygmic interval. Griffith shows tracings from a case of myotonia congenitalis which indicate a postponement of this wave, as if relaxation of the contraction of the ventricular muscle was delayed.

Griffith believes that the aortic valves are enabled to sustain the increased pressure of the blood due to the ventricular contraction more effectively because the aortic conus enters into contraction later and remains contracted longer than any other part of the heart. The occurrence of a third wave between the C and A wave is often associated with a third heart sound, heard either at the apex, or at the base, or in both locations.

In the variety of extra-systole known as auricular there is a premature contraction of the auricle. This may appear in the jugular pulse as a separated wave or it may blend with and modify the ventricular wave of the previous cycle. It is followed by a contraction of the ventricle, which it evokes by the sending of a stimulus along the usual channel. In most cases this stimulus passes slowly, so that the prematurity of the ventricular beat is not so marked as that of the auricle.

If the irregular period is not less than two spaces the extra-systole is probably auricular in origin; but the converse statement, namely, that if the irregular period is not less than two spaces the extra-systole is ventricular in origin, cannot be made, for such a condition prevails in certain examples of auricular extra-systoles. Like the ventricular extra-systoles, these auricular extra-systoles often occur rhythmically.

In addition to those extra-systoles which arise in the ventricle and those which arise in the auricle, it is held that a third variety is constituted by those which are due to a stimulus arising in some part of the auriculoventricular junctional tissue, most probably in the immediate neighborhood of the node, or in that structure itself. These are termed "auriculo-ventricular," and opinions vary greatly as to their frequency. There are many cases, however, in which the interpretation is beset with difficulties.

When a small and large beat occur in close succession followed by a longer interval the condition is known as pulsus bigeminus; when the small and the large beat succeed each other at regular intervals it is known as pulsus alternans. Each alternate contraction is feeble, and as this usually results in some delay in the appearance of the radial pulse, we find that in this case the distance between the large beat and the small beat is usually greater than that which separates the small beat from the large one.

The explanation of the pulsus alternans which has the largest element of probability is as follows: When a strong systole of the ventricle takes place it lasts a relatively long time, so that when a stimulus again reaches the ventricle it has not had a long rest, and is unable to respond by a strong contraction. The weak contraction which is all it can attain to, is also a short one, so that when the next stimulus arrives for ventricular activity the muscle is found to have had a long rest, and responds with a strong contraction. Alternation of this kind may prevail for two or three beats after an extrasystole without casting any reflection on the cardiac musculature. If, on the other hand, it persists for a considerable time, either when brought on in this way or, as is supposed to be common, as a result of a weak contraction due to some other cause, it is regarded as of very grave prognostic significance, indicating, as it probably does, some serious weakness of the cardiac muscle.

#### HEART-BLOCK.

Adams-Stokes Disease. D. Gerhardt<sup>4</sup> reports a number of cases of Adams-Stokes disease with some interesting features. The first illustrated the possibility of the complete disappearance of a fully developed total

<sup>(4)</sup> Deutsches Archiv. f. klin. Med., May, 1912.

heart-block. In the case reported microscopic investigation showed the presence of a very marked focus of degeneration in the immediate neighborhood of the conducting system (bundle of His), which had occasioned severe clinical symptoms lasting only a few days and afterwards permanently disappearing. The disturbances of conductivity were coincident with a severe hemorrhage from the stomach. The author explains a possible connection of the two phenomena by supposing that the loss of blood caused a thromboses in the coronary arteries which were narrowed by atheroma, and that necroses occurred in the area to which they were distributed, so that the focus of degeneration was caused indirectly by the hemorrhages. A second hypothesis is that the loss of blood was sufficient temporarily to suspend the function of a part which performed a compensatory function made necessary by anatomic disease of the main part of the bundle. A third hypothesis is that the function was suspended as a result of reflex influences in addition to the anatomic defect. In this case the history of the patient affords a good illustration of the fact that in spite of a severe anatomic lesion which had led to the appearance of threatening attacks of suspended ventricular action, the function of the conductive system may be re-established and continue in spite of new injurious factors.

In contrast with such cases was one in which an apparently quite chronic destructive process suddenly gave rise to numerous attacks of heart-block, and after a temporary improvement, to one which resulted fatally.

The author discusses the possibility of the production of dissociation through the action of the vagus, and after citing some cases from the literature reports one of his own. In this case extreme bradycardia, with temporary heart-block, and attacks of pallor and syncope were caused by the pressure of a tumor on the left vagus. The pressure was produced by bending the head backwards. The attacks did not recur after the administration of atropine.

Clinical Cases. L. Gallavardin<sup>5</sup> reports three cases

<sup>(5)</sup> Lyon Méd., Dec. 17, 1911.

of Adams-Stokes disease with total block in the course of different diseases of the heart, notably in an aortic rheumatismal lesion in a man of 32 years. He calls attention to the following interesting points:

1. With reference to total block he points out that the variations observed from one day to another in the automatic rhythm of the ventricle always appeared to be accompanied by variations either parallel or of the same character in the number of contractions of the auricle. It must be concluded, therefore, that if in total block the ventricle no longer depends on the auricle, the two cavities nevertheless remain under certain general influences either of the circulation or the nervous system, which are capable of modifying their activity in the same direction.

He calls attention also to the frequency of extrasystoles during the condition of block. A notable character is the absence of the compensatory pause, which is so characteristic of those extra-systoles which arise in the automatic action of the ventricle, and which permit the diagnosis of total block by the sphygmographic This absence of the compensatory pause is easily explained by the fact that the ventricle, in order to contract, is no longer obliged to wait for the indication furnished by the auricular contraction which follows that which found it in an inexcitable condition. The new ventricular systole is produced as soon as the myocardium has recovered from its periodic inexcitability, and there is no reason why this inexcitable period should be prolonged after an extra-systolic contraction any more than after a normal contraction.

2. While in these three cases the Adams-Stokes syndrome was accompanied by total block, it is not necessary to suppose that all cases of Adams-Stokes disease must present this peculiarity. Heart-block is not an obligatory symptom of this affection but simply an ultimate result.

3. The relations between the installation of the block and the appearance of nervous symptoms must be explained differently in the three cases.

4. Finally the coexistence of an affection of the

heart in the three cases needs especial emphasis. In the first two cases cardiac hypertrophy of renal or aortic origin was concerned, and in the last a large aortic rheumatic lesion.

A. W. Meyer<sup>6</sup> reports two cases of disturbance of the conducting power which are somewhat unusual. In the first case a complete block between the auricle and ventricle occurred so that the ventricle assumed an automatic rhythm of 54. The auricle, however, began to beat at the remarkable rate of 18. After a time this rate was changed to 34. This the author explains by supposing that there was an incomplete heart-block between the sinus and the muscle of the auricle, so that the muscle of the auricle responded at first to every third impulse from the sinus, and later to two out of three such impulses. These phenomena were the result of the administration of digitalis. Later the disturbance of conduction disappeared and the rhythm of the heart returned to a beat of 78 for both auricle and ventricle.

In the second case there was an Adams-Stokes syndrome depending upon complete heart-block due to an anatomic lesion, and yet after the treatment with digitalis the blood-pressure rose and the appearance and condition of the patient became markedly better. The author is of the opinion that the digitalis treatment was

efficient in postponing the final fatal result.

Heart-Block in Acute Infections. J. Cowan, G. B. Fleming, and M. Kennedy' report a number of cases indicating the occurrence of heart-block or nodal rhythm in acute infections. In a case of diphtheria, with full heart-block, the a.-v. bundle and node were found to be involved in an acute inflammatory process, and similar lesions were present in the a.-v. bundle in a case of malignant endocarditis in which conductivity was defective. In three cases of acute endocarditis, with nodal rhythm, the a.-v. node was acutely inflamed, the bundle being only and but slightly affected in one instance.

The peculiarities of the tracings and particularly the

<sup>(6)</sup> Archiv. f. klin. Med.(7) Lancet, Feb. 3, 1912.

shortened a.-c. interval correspond to conditions found in cases of paroxysmal tachycardia. The cases reported cannot, however, be regarded as examples of paroxysmal tachycardia. In all three the sequence of events was similar, the tracings showing at first a normal rhythm interrupted by occasional extra-systoles, and preceding death a regular more frequent action with a short a.-c. interval. In no case was the tachycardia excessive or paroxysmal or the onset of the new rhythm abrupt. It seems probable that nodal rhythm is not so uncommon as it would appear to be from the scarcity of records, for an apte-mortem rise in the pulse-rate attracts little special attention, though an infrequent or an irregular pulse does not escape investigation.

The inception of heart-block or nodal rhythm may conceivably be the proximate cause of death; for the mechanical difficulty under which the heart labors in these rhythms must be very considerable, the synchronous contraction of auricles and ventricles throwing the auricular blood backwards into the veins, and lessening in considerable degree the ventricular content and output. The blood-pressure in these cases is in consequence always low and the pulse is always small. The serious import of paroxysmal tachycardia is now thoroughly recognized, for the continuance of a paroxysm for more than a few hours is known to lead rapidly to dilatation of the heart, a result which will ensue the more readily in cases where the valves are inflamed and the cardiac muscle degenerated and weak.

It is well known that an infrequent pulse is occasionally associated with some forms of toxemia, particularly those which accompany catarrhal jaundice and chronic nephritis. An infrequent pulse may be due to three different causes: (1) the regular occurrence of extra-systoles not perceptible to the finger on the pulse (coupled rhythm); (2) heart-block, partial or complete; and (3) slowing of the whole heart. It is only since the introduction of the graphic method of studying heart affections that it has become possible to distinguish certainly between these distinct conditions. It has been ascertained that the slow pulse of jaundice

is most often due to a coupled rhythm, much less commonly to a slowing of the whole heart. As regards the pulse in nephritis, little is at present known either as to its nature or its cause. It is not yet considered as proved to be due to uremic poisoning, and Vaquez and Esmein, in their report on bradycardia to the French Medical Congress last year, state that the question needs further research.

E. E. Laslett<sup>8</sup> reports a case of bradycardia in association with uremia occurring in a man 42 years of age, suffering from an attack of nephritis. He was attacked with a chill and on the fourth day the urine was less than 10 oz. He was rather drowsy, complained of constant headache, and vomited several times. The pulse ranged from 42 to 72. The blood-pressure, measured when the pulse was slow, was found to be 150 mm. Hg., systolic (Hill).

From the tracings it was evident that it is a question of a slowing of the whole heart, auricles and ventricles being equally affected. The a.-c. interval is normal.

Danielopolu has recently reported two cases of bradycardia observed in the course of nephritis. In both cases the slow pulse was due to a true bradycardia from increased inhibition. In one of the cases the development of the slow pulse was observed, and the writer considers that there is good evidence that the bradycardia was due to uremic intoxication. present case the infrequent pulse was due to a true bradycardia. It was a new feature, never having been observed in his previous acute attacks, and inasmuch as the gradual development of the bradycardia coincided with the onset of uremic symptoms, and its cessation with the increase of urine and the disappearance of the dangerous symptoms of poisoning, it is at least very suggestive that the condition of the heart was due to the uremic poison acting probably through the inhibitory mechanism. The fact that the bradycardia was observed only in the last attack and never during the previous long illnesses may possibly be related to the

<sup>(8)</sup> Lancet, Oct. 7, 1911.

acuteness of onset of the symptoms of uremia and the

rapid diminution of urine.

Pathology. A. Mills Kennedy, reports a case of somewhat typical Adams-Stokes syndrome which came to necropsy. No fibrosis could be made out in the myocardium. There were no valvular lesions, but the aorta showed well-marked atheroma of the syphilitic type. The coronary arteries were very slightly atheromatous. As nothing could be found by the naked eye to account for the Adams-Stokes syndrome a number of sections were made of the auriculo-ventricular node and bundle with the following result:

Examination of the sections showed that the a.-v.node, the lower portion of the a.-v. bundle and its principal branches were healthy. The fibrous sheath of the bundle, however, was greatly thickened, this being particularly marked on the right side of the bundle, and in its lower portion there was abundant calcification. Beyond the bifurcation of the bundle, between its two principal branches, the fibrous tissue was thickened and showed a fair amount of calcareous deposition. Following the thickened and calcareous right side of the sheath upwards to the upper half of the bundle, the fibrosis was seen to extend inwards across the bundle and cause a complete break in its' continuity at thispart. Here the fibrosis appeared as longitudinal strands of fibrous tissue; in places the margins of the strands were rather cellular, showing fibroblasts mixed with the remains of the "bundle tissue," and in other places some calcification in the fibrosed tissue had occurred. The calcification, although abundant in the sheath on the right side of the bundle, and also present in the sheath on the left side, was scanty within the bundle proper.

The ventricular muscle showed a moderate degree of fibrosis and occasionally slight calcareous depositions in the fibrous strands. In all probability syphilis was the etiologic factor in the case. The vagi were not examined.

The main bundle of the auriculo-ventricular junc-

<sup>(9)</sup> Glasgow Med. Jour., March, 1912,

tional system being the path by which the auricular contractions are transmitted to the ventricles, it may be inferred from the pathologic findings alone in this case that a condition of complete heart-block was present during life. In the absence of tracings it is impossible to say positively that a complete block was present, but the pulse-rate noted in this case is recognized to be about the normal independent ventricular rate.

## ANGINA PECTORIS.

# Embolus and Thrombosis of the Coronary Arteries.

According to J. B. Herrick<sup>1</sup> there is a form of angina due to embolic or thrombotic closure of a coronary artery possessing certain features that enable one to diagnose it with a fair degree of certainty. A rapidly developing obstruction of a coronary artery may cause sudden death. But such destruction, if slowly developing, or even if extensive, and developing quite rapidly. may not prove immediately fatal. The left coronary. for example, may be completely plugged close to its origin and yet the patient may live for many hours or for several days. The area of the myocardium supplied by such obstructed artery naturally becomes anemic, ultimately necrotic and, to a large extent certainly, functionless, although in an imperfect and halting way the damaged heart muscle may for a time perform its function.

Aid is furnished the anemic area to some extent from anastomosing vessels and the vessels of Thebesius opening directly from the heart chambers. Small areas of this kind, from obstruction of small twigs of the coronaries, may scar over and be classed as one of the causes of the fibroid heart, the so-called chronic fibrous myocarditis. Such small obstructions are, perhaps, the cause of certain slight attacks of angina, of some of the "sticking pains" in the heart region.

Herrick reports the case of a man between 50 and 55 years of age, supposedly in good health, who was seized an hour after an ordinarily full meal with severe pain in the lower precordial region. He was nauseated and,

<sup>(1)</sup> Jour, Iowa State Med. Soc., Qct. 15, 1911,

believing something he had just eaten had disagreed with him, he induced vomiting by tickling his throat. The pain continued, however, and his physician was called, who found him cold, nauseated, with small rapid pulse, and suffering extreme pain. He washed out the stomach and gave morphine hypodermically. The pain did not cease until three hours had passed. From this time the patient remained in bed, free from pain, but the pulse continued rapid and small, and numerous râles appeared in the chest. When seen twelve hours after the painful attack there was a clear, calm mind, a moderate cyanosis, a chest full of fine and coarse moist râles, a running, feeble pulse of 140. The heart tones were very faint and there was a most startling and confusing hyperresonance over the chest, the area of heart dulness being entirely obscured. The abdomen was tympanitic. The urine was scanty, of high specific gravity, and contained a small amount of albumin and a few The temperature was subnormal, later going to Occasionally there was nausea, and twice a sudden projectile vomiting of considerable fluid material. This condition remained with slight variations up to the time of his death, fifty-two hours after the onset of the pain, though at one time the râles seemed nearly to have disappeared. A few hours before death the patient described a slight pain in the heart region, but said it did not amount to much. A remarkable circumstance. and one that occasioned surprise in those who saw him and who realized from the almost imperceptible pulse and the feeble heart tones how weak the heart must be, was the fact that the patient not infrequently rolled vigorously from side to side in the bed, or sat suddenly bolt upright, or reached out to take things from the nearby table, and once, feeling a sudden nausea, jumped out of bed, dodged the nurse and ran into the bathroom, where he vomited, and yet seemed none the worse for these exertions.

The heart in this case was of normal size, but both coronary arteries were markedly sclerotic, with calcareous districts and narrowing of the lumen. A short distance from its origin the left coronary artery was

completely obliterated by a red thrombus that had formed at a point of great narrowing. The wall of the left ventricle showed well-marked areas of yellowish and reddish softening, especially extensive in the interventricular septum. At the very apex the muscle was decidedly softer than elsewhere. The beginning of the aorta showed a few yellowish spots, these areas becoming less marked as the descending part was reached.

An acute fibrinous pericardial deposit, which showed no bacteria in smears, was found over the left ventriele. The pericarditis probably explains the slighter pain com-

plained of a few hours before death.

There was marked edema of the lungs. In other re-

spects the anatomic findings were those of health.

Herrick is convinced that cases of this nature are not so very uncommon, and that at times it may be possible to recognize this condition at the bedside. The pain when the closure takes place is sudden, severe and the attack is prolonged. This latter fact is perhaps of significance. The patient may be one who has had anginal attacks before, or, as in the history just reported, the seizure may be the first one. In the former case the patient will realize the greater severity of this attack, and often its greater duration. The pain does not necessarily radiate to the neck and left arm, though this is common.

Epigastric distress, nausea and vomiting, shock and collapse, with a small, rapid, perhaps irregular, pulse may make one think of some subdiaphragmatic accident, such as hemorrhagic pancreatitis, perforation of gastric ulcer, diaphragmatic hernia. And the confusion is not cleared up by the acute emphysema of the lungs that may develop with numerous moist râles as in pulmonary edema. What may also greatly mislead one is the way in which the heart after the initial shock may for a time recover its tone and be able to perform its work with a fair degree of efficiency.

Herrick has seen five other cases. In all of these previous angina had been present, and there was some evidence of previous arteriosclerosis. In all the final attack was the severest ever experienced by the patient,

was longer and was relieved only by morphine, nitroglycerin being unavailing. In all the sudden development of weak, rapid pulse, with feeble cardiac tones, was a striking feature. In one the heart dilated. Dyspnea and cyanosis varied in degree. Râles, as in edema of the lungs, were present. Emphysema was variable. Only one patient left his bed after the attack. His pulse showed a great improvement in quality and rate, though dyspnea, râles, edema of the legs, etc., showed cardiac failure. The cardiac weakness in one man was extreme from the onset to his death, some twelve days later, and slight movement in bed brought on precordial distress and dyspnea-status anginosus. From the time of the obstruction—time of seizure—to death was in one case three days, one seven, two twelve, and one twenty. recurrence of pain took place in any save the one case where there was the anginose state.

Effect of Poisoning on the Coronary Arteries. J. Pal<sup>2</sup> reports some interesting observations on the effect of poisoning on the coronary arteries and the bronchioles. He finds that the following substances dilate the coronary arteries of the beef heart: Atropine, epinephrin, caffeine, theobromine, cocaine, and the nitrites. The following have a constricting action: Muscarine, pilocarpine, physostigmine and pituitrin. He finds that in general the substances which contract the coronary arteries also contract the bronchioles and vice versa. The substances which relax the coronary arteries as a rule will counteract the contracting influence exerted on the bronchioles by those substances which cause bronchial spasm as in asthma.

# MYOCARDITIS.

Abscess of the Myocardium. L. Babonneix and Baron<sup>3</sup> report a case of malignant endocarditis of the aortic orifice accompanied by an abscess of the myocardium in which the cardiac symptoms were so latent that the diagnosis of hepatic abscess was made, and it was believed that the signs of suppuration in the liver

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 <sup>(2)</sup> Deutsche med. Wochenschr., Jan. 4, 1912.
 (3) Gaz. des Hôp., Jan. 11, 1912.

were so evident that it was thought necessary to operate. The febrile attacks, the sharp pain in the liver, and the enlargement of the organ which was caused by the perihepatitis and congestion, together with the absence of cardiac signs, completely obscured the diagnosis.

The authors refer to the frequent mistakes in the diagnosis of malignant endocarditis when the general signs of sepsis are predominant. This difficulty of diagnosis was noted by Laennec, and the fact that a murmur was often lacking was observed by him. To-day, with all our advance in auscultation, modern authors agree in saying that the local signs of vegetative endocarditis offer nothing characteristic, and that they may even be quite lacking. Moreover the presence of an abscess of the myocardium complicating such an endocarditis is not likely to elucidate the diagnosis. For the symptoms of abscess of the myocardium are still more obscure than those of the infectious endocarditis which gives rise to These local symptoms are slight and uncertain. Sometimes there is a precordial pain and arrhythmia, but in many other cases there is no marked heart symptom and the abscess is discovered only at necropsy. At the present time the conclusion which Laennec made in his Traité des Maladies du Thorax is still pertinent; "It is impossible in the present state of science to point out signs by which one can recognize an abscess of the heart."

Myocardial Changes. H. Brooks presents a study of the myocardial changes in 187 cases of endocarditis. He classifies the ways in which the heart muscle may become involved in endocarditis under the following chief heads:

- 1. It may become diseased as a common result of the process or condition under which the endocarditis itself develops.
- 2. It may result from embolic plugging of one of the coronary vessels from the dislodgment of necrotic material from the diseased valve, from embolism by lodgment of the bacteria circulating in the blood-stream

<sup>(4)</sup> Amer. Jour. Med. Sciences, December, 1911.

which may have caused the endocarditis, or from hyaline thrombi.

3. The muscle may become involved as the result of ischemia following obstruction at the opening of the coronary vessels or in the course of their lumen.

4. It may become diseased by the direct extension of the ulceration from the point of valve disease into

the myocardium.

5. Myocardial degeneration or inflammation either acute or chronic may be directly set up as a result of

a superjacent endocarditis.

6. Involvement and fibrosis of the muscle may readily originate in the papillary muscles whose integrity has been first compromised by the overstretching which follows cardiac incompetence or relaxation of the valve rings. This may be followed by a more or less generalized fibrosis extending from these foci.

7. Disease and especially fibrosis of the auricles undoubtedly follows the auricular distention dependent on ventricular irregularities due to disturbed muscular

conductivity and arrhythmia.

8. Banti, according to Adami, has shown that venous stasis such as occurs very commonly in various diseases of the heart, including valve lesions, may in itself produce changes in the muscle bands which become of grave import.

- 9. Probably most frequent of all is the disease of the myocardium, notably that of the ventricle, which occurs from other causes entirely independent of endocarditis. This was definitely the case in 81 of the 176 instances of associated endocarditis and myocardial disease in the author's 187 cases of endocarditis.
- 10. There can be no doubt that other cases occur in which the myocardial lesions are definitely dependent on the primary endocardial disease. These instances are, however, from their very nature, difficult or impossible of definite post-mortem recognition.

The author reaches the following conclusions:

1. Myocardial disease is present in greater or less degree in practically all cases of endocarditis, acute or chronic.

2. The type and degree of these changes determine, to a large degree, the possibilities and the future of any case of endocarditis.

3. The most frequent changes in the myocardium in association with endocarditis are degenerative ones,

Inflammatory lesions are relatively rare.

4. In most instances the myocardial change is not determined by, nor is it the direct result of the endocarditis, but is caused independently by the same, affili-

ated, or by entirely independent conditions.

5. The most frequent form seen in chronic or late acute cases is fatty degeneration, a lesion which differs in no material histo-chemical respect from that involving voluntary muscle. From analogy, it seems that this degeneration in most instances succeeds a primary parenchymatous alteration. As a sequence to fatty degeneration, fibrous replacement, and probably brown atrophy frequently appear.

6. There is no regular association between the special valve lesion and the type of associated myocardial degeneration, except that these changes appear more constantly and in more serious grade in aortic than with other lesions, probably because of mechanical

reasons.

Cardiac Dilatation. Brooks<sup>5</sup> divides the treatment of cardiac dilatation occurring in acute fevers into prophylaxis and the treatment of the fully developed lesion. For prevention the toxemia of the acute disease should be combatted by elimination, by catharsis, diuresis and diaphoresis. If a specific for the primary disease is known the earlier it is given the better, as far as protection of the heart muscle is concerned. The author is not in favor of attempting the control of overaction of the heart by drugs. The icebag to the precordium is his favorite method. He does not advise the use of coal-tar products for the control of high temperature. All unnecessary straining of the circulatory apparatus should be avoided. Rest in bed, with the interdiction of certain movements such as sudden sitting up or turning, are very necessary. Relief from

<sup>(5)</sup> N. Y. Med. Jour., Sept. 9, 1911.

mental excitement and stress and from any other factor which may cause a rise of the blood-pressure, especially a sudden one, or which may excite increased

rapidity in the heart action, is very essential.

The patient with, or convalescing from, the acute fevers should rest in bed. Blood-pressure and strain must be kept down by hygienic and dietetic measures or, if necessary, by blood-letting or sedatives until the heart muscle has been able to regenerate itself. The natural tendency in parenchymatous degeneration of the myocardium is toward recovery, but if strain is put upon the heart too early and before this restitution has taken place, aneurism, fibrosis, or a fatty degeneration is sure to follow.

The diet should not contain too much fluid, and fatty foods, starches and sugars, should be curtailed. Other conditions not contra-indicating, Brooks is strongly in favor of a highly nitrogenous diet in this stage of con-

valescence.

Frequent examinations of the heart under varying conditions and postures should be made and, before the patient is allowed to be up and to go about, all medication should have been first discontinued so that we may in our examinations be able accurately to determine the real condition of the heart and to estimate its muscular strength rather than to be misled, perhaps, by the action of the heart muscle when under the whip of a stimulant. In any case, examinations of the circulatory condition should be made from time to time until convalescence is complete.

### ENDOCARDITIS.

Acute Endocarditis. L. Frissell<sup>6</sup> reports a case in a patient, aged 52, who entered the hospital with the history of gradually increasing dyspnea. There was evidence of some enlargement of the heart with a thrill and a systolic murmur. The patient died after three months and the necropsy showed that the chordæ tendineæ had been torn from the anterior cusp of the mitral valve—an evidence of acute endocarditis. They also showed evidence of an old chronic inflammation.

<sup>(6)</sup> Med. Record, Apr. 20, 1912.

The author sums up the main features of the case as follows and summarizes the 50 cases previously reported.

The case presented is of unusual interest on account of the rarity of the lesion, its mode of production, and the occurrence of a presystolic murmur in the absence of stenosis of the mitral valve. A review of the literature shows 50 reported cases, including eight ruptures of papillary muscles, a synopsis of which is appended to the present report. Many of them are old, some in the days before the use of refined methods of physical examination, and even that reported by so great a master as Laennec is difficult of analysis, owing to the incorrect views obtaining as to the production of the second heart tone, so that his statement that "the contraction of the auricle as long as that of the ventricle donnait le bruit de soufflet," leaves one in doubt as to his meaning. Presumably, as he regards the second sound of the heart as synchronous in time with auricular systole, the murmur heard was diastolic in time. As regards the cause of the rupture, the tendency of the early observers is to lay stress on physical effort and trauma, though if the cases be analyzed in many of them an endocarditis was obviously present, as proven by vegetation or valve change described in the autopsy reports. These changes were considered by some as secondary, but precisely on what ground it is difficult to see, except from the absence of symptoms prior to the trauma or strain.

On dividing the cases as reported it seemed wise to classify them as follows:

1. Those cases due to severe traumata such as fractured ribs from violent compressions, falls from a considerable height, stab wounds, gunshot wounds; in one the kick of a horse. Of this group seven cases were found, resulting in four cases in a tearing of the papillary muscle rather than the chordæ themselves. The remaining three were due to stab and gunshot wounds and a fall from a window, respectively. That trauma of such severity in the region of the precordium could result in rupture of the chordæ will be admitted without comment.

2. Cases of ruptured chordæ in which the rupture has followed efforts such as straining, lifting, excessive fatigue, and severe cough in which the autopsy disclosed no reported endocardial lesions in the heart. Of these five cases are reported, of which two showed blood-vessel lesions, one an aortic aneurism, and the other coronary sclerosis. Two cases also showed papillary muscle rupture, leaving only one case of actual chordæ rupture in hearts apparently free from any other lesion. the case of Dickinson. The patient, a young male, 21 years of age, had a severe pain under the left nipple while lifting a load of bricks, developed immediate signs of cardiac insufficiency, and died in two months. necropsy record carefully describes the valves as normal except for rupture of the chordæ attached to the posterior cusp of the mitral valve.

3. Cases of rupture said to be due to or preceded by strain, but in which endocardial or myocardial lesions were also found at autopsy. In this class nine cases.

are found.

4. Cases of rupture of the chordæ, in which endocardial lesion was found, but following no known history of strain or trauma. In this class are nineteen cases. Among these are a number in which no history was given or obtainable, these constituting a sub-class of mere pathologic reports.

5. Reported cases of rupture in which data given are insufficient to determine the probable cause in which no necropsy has been made, and one ("Gilbin") whose report was not accessible. In this class are ten cases.

Endocarditis Simulating Uremia. Levy, J. Chalier, and L. Nové-Josser<sup>7</sup> report a case of pneumococcic septicemia involving the meninges, and producing an ulcerative endocarditis, which produced symptoms which were taken to indicate uremic poisoning. Examination of the heart permitted no diagnosis, as there was no murmur. There was albuminuria, but the necropsy revealed no lesion of the kidneys. It was only by examination of the cerebrospinal fluid that evidence of the meningitis and the nature of the infection was obtained.

<sup>(7)</sup> Lyon Méd., Feb. 18, 1912.

Blood-Pressure in Endocarditis. V. T. Korke<sup>8</sup> draws the following conclusions from the investigation of 34 cases of heart disease, mostly rheumatic endocarditis:

1. In valvular lesions of the heart (with or without complications), due to rheumatic endocarditis and other causes, the blood-pressure was found to be normal or above normal.

2. In simple and uncomplicated valvular lesions of the heart, due to acute rheumatic endocarditis, the blood-pressure was found always to be normal or above normal. These results agree with those arrived at by Starling.

3. In a ortic incompetence complicated with anginal attacks, the blood-pressure was found to be *subnormal* during the interparoxysmal periods. The low systolic blood-pressure is, perhaps, an expression of the failing

power of the myocardium.

Significance of high blood-pressure in simple and · uncomplicated valvular lesions of the heart due to rheumatic endocarditis. The high blood-pressure observed in some of the cases is a physiologic compensation in those individuals, though it may be mistaken for a pathologic state. As is well understood, the normal blood-pressure is maintained by the co-ordination of the three factors—viz., (1) Rhythmic and forcible contraction of the myocardium; (2) tonic action of the arterial walls; and (3) contraction of the arterioles. In valvular diseases of the heart the defective normal action of the myocardium must be corrected, first, by making a demand on its reserve power; secondly, by supplying a proper amount of blood under the altered circumstances, thereby maintaining a new blood-pressure level. Vaso-constriction is the first effort made to correct the myocardial insufficiency by inciting the ventricles to restore the proper output to its previous amount (Starling). Consequently the height of blood-pressure may vary according to the degree of vaso-constriction, and condition and demand of the myocardium.

For such patients, therefore, who showed no complications and who were comparatively active and com-

<sup>(8)</sup> Lancet, Dec. 2, 1911.

fortable, an average level of arterial blood-pressure even above normal was absolutely necessary to ensure the requisite speed of capillary blood flow. In such cases the high blood-pressure was not incompatible with average normal health.

5. The blood-pressure in cardiac muscle failure was normal or well above normal. Korke believes that the high blood-pressure in cardiac muscle failure was due to various pathologic causes which produced a change in the myocardium.

6. In valvular lesions, complicated with chronic nephritis and arteriosclerosis, the significance of supernormal blood-pressure requires no comment. It is dis-

tinctly pathologic.

Chronic Infectious Endocarditis. -W. Osler<sup>9</sup> reports a case of chronic infectious endocarditis with an early history like splenic anemia in a man of 33. The spleen was enlarged, reaching nearly to the navel; the liver was normal. There was a soft apex systolic murmur which we naturally associate with the anemia. He had a temperature of 102.5°F. The blood-count by Kemp showed 2,700,000 erythrocytes, and 8,000 leukocytes. The differential count gave: Polymorphs, 40 per cent.; large lymphocytes, 45 per cent.; small, 13; myelocytes, 2.

There were one or two other interesting features in the case. In the middle of August the patient had a most extensive herpes on the right flank, the individual vesicles of which became purpuric. On several occasions he had bleeding from the gums, and throughout the illness occasional outbreaks of purpura. At first the vaccine treatment, which was carried out by Gibson, seemed to reduce the fever, but subsequently it did not appear to have any special influence, and this accords with the author's personal experience, for he has not seen a case in which any permanent benefit followed.

The patient died on the 13th, having had dyspnea for several days, but no increase in the fever. The cheeks and nose became covered with petechiæ, and shortly before death, which took place suddenly, there was

paralysis of the right arm.

<sup>(9)</sup> Interstate Med. Jour., February, 1912.

There was disease at the aortic valve but not at the mitral as at first supposed. Infarcts were found in the spleen and there was diffuse nephritis, shown during life by albumin and some blood in the urine. Osler summarizes certain of the important features of this type of endocarditis as follows:

1. Chronicity. Six, eight, ten, twelve, and even for thirteen months the symptoms may persist and there are instances of even longer duration. It has been well called endocarditis lenta.

2. Latency. For months there may be no indication whatever of endocarditis. Osler has seen a case in which fever persisted for six or seven months,—fever and nothing else, and the diagnosis was not possible until the

cardiac signs became pronounced.

3. The fever is of the so-called septic type, the daily rise reaching to 102.5° or 103° F. Month after month it may not vary the fraction of a degree. Chills may occur at intervals, but the cases may run the entire course without them. A special septic feature of the disease is the anemia.

4. Embolic attacks which are present in a considerable number of cases, and which may give the first intimation of the true nature of the trouble. In the case reported, it was the femoral aneurism which at once suggested the existence of endocarditis, and a few days later a murmur of aortic insufficiency was present.

5. Ephemeral cutaneous nodes, which are pathognomonic. They are small, swollen areas, usually about the hands or feet; raised, reddish nodes, not unlike an ordinary weal, painful, but they disappear in the course

of a day or two.

6. Blood-Cultures. In a majority of all cases, organisms are present in the blood, and may be grown on appropriate media. The studies of Schotmüller, Libman and others have determined that the common organism in this type of subacute infective endocarditis is a streptococcus, known as mitior or viridans, because the colonies are those of a poorly-growing organism and produce a green pigment on blood-plates. But in addition to this organism the influenza bacillus, the pneumo-

coccus, and the staphylococcus may also be present.
7. Lastly the endocarditis is pathologically unlike the ordinary ulcerative form. There are usually large, firm, hard, grayish-yellow vegetations projecting from the valves like condylomata, and a special feature in many cases is their widespread extension on the mural endocardium. A glance at the condition of these aortic valves neutralizes at once any disappointment one may feel at the failure of the vaccine treatment,—one can-

not expect miracles.

Septic Endocarditis. J. Henderson¹ reports nine cases of septicemia with local endocardial lesions and gives the following review of the treatment: The outlook in such cases has all along been a hopeless one, and the records are almost entirely those of failure. Drugs of all kinds have been tried, and have proved equally disappointing, even when administered under the best conditions. Certain so-called blood antiseptics have been recommended and used in general septicemic infections, and sometimes apparently with good results, but in this variety of septicemia, with local infective cardiac lesion, they have proved of no avail.

The most hopeful results from drugs have been obtained from the use of collargol, and protargol by inunction, as recorded by Ewart and Morley, and more recently by Cowan. These, however, were in cases in which, so far as can be gathered, no organism was isolated from the blood during life. By this means temporary benefits, lasting for several months, have resulted. So far, however, no specific has been found for this condition.

The introduction of antistreptococcic serum, and particularly the polyvalent serum, might reasonably have been expected to prove of benefit, because of the great preponderance of streptococcic cases; but here again no success has been obtained. Horder has tested this line of treatment very thoroughly, without any permanent good resulting, though occasionally he has noted temporary benefit. In considering these results of treatment it must not be lost sight of that, in a number of

<sup>(1)</sup> Lancet, Sept. 14, 1912.

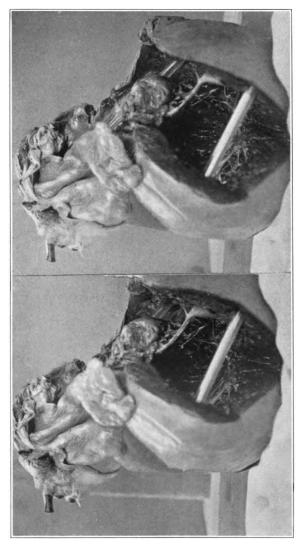
cases, even without special treatment, periods of apparent or real improvement may supervene, so that under certain forms of treatment the subsequent tem-

porary benefit may be a mere coincidence.

It is possible, following on Horder's observations relative to the variety of streptococci causing infective endocarditis, that the failure of antisera may be explained by the exceptional nature of the streptococci, as the ordinary stock antisera are usually prepared from various strains of *Streptococcus pyogenes*. The same difficulty arises with a polyvalent serum, as this is prepared, not from streptococci of known difference in reaction, but from those from different diseased conditions.

The introduction of vaccine therapy, however, has overcome this difficulty, and has shed a ray of hope on the treatment of such conditions, though, even along these lines, the success which might reasonably have been anticipated has not been realized. The main difficulties in the way here are: (1) that many of these cases are so acute as to allow no time for the preparation of a vaccine; (2) that in some cases, even on repeated attempts, no organism can be cultivated from the blood; (3) that sometimes the organism may be isolated too late for its discovery to be of any therapeutic value. There remain, then, cases of the more chronic type, in which a definite organism is isolated in time to prove of possible service beyond merely confirming the diagnosis.

In a number of recorded cases of this type a course of vaccine treatment has been carried out without any permanent check to the progress of the disease, though in several the treatment was followed by a marked improvement. Horder has recorded a striking result in one case of influenzal endocarditis, diagnosed by blood-culture, in which treatment by an autogenous vaccine produced diminution of fever, gain in weight, improvement in color, and a sterile blood-culture. Later, however, he has had to record a relapse in this case and a fatal issue, in spite of a third course of vaccine treatment. The only case recorded as successful so far



Stereoscopic photograph of aneurism of the anterior cusp of the mitral valve in a case of staphylococcal endocarditis.—Calwell, (Page 249.)

under this form of treatment is that published by Barr,

Blair Bell, and Douglas.

Although vaccine therapy has met with so little success, even in cases which appeared suitable for its use, it seems, from the nature of the disease, to be along such lines that we must look for ultimate success, aided by riper experience and perfected methods. It is only by repeated trials of specific inoculation in every possible case that we can hope to further this end.

Though there is, so far, no specific means of combating the infection, something may be accomplished towards preventing the possibility of secondary infection in cases of rheumatic fever and in patients known to have valvular defects. In such it is our duty to be increasingly watchful, to aid convalescence by all the general means in our power-rest, good feeding, careful nursing, tonics—and especially to combat the anemia. which is such a prominent feature in prolonged rheumatic attacks, and one which favors the onset of a malignant process. Further, knowing, as we do, that in many cases the source of infection is the mouth or intestine. any condition of oral sepsis should be rigorously treated. Large unhealthy tonsils should be removed, as these form a suitable nidus for infective organisms. Careful regulation of the bowel also, by preventing the retention of fecal matter, must tend to lessen the chances of infection from that quarter.

Staphylococcis Endocarditis. W. Calwell<sup>2</sup> reports the case of a boy, 16 years old, who died of staphylococcic endocarditis after an illness of about ten weeks. The necropsy showed an aneurism of the anterior cusp of the mitral valve and an abscess in the spleen which gave a pus that afforded a pure culture of staphy-

lococcus. (See Plate V.)

## VALVULAR DISEASE.

Compensation. According to T. R. Bradshaw,<sup>3</sup> an amount of regurgitation or stenosis sufficient to give

<sup>(2)</sup> Brit. Med. Jour., Oct. 5, 1912.
(3) Liverpool Med.-Chir. Jour., January, 1912.

rise to an audible murmur may be present at any of the cardiac orifices without interfering in any appreciable degree with the efficient action of the heart. If this view is correct, the gravity of valvular disease varies between, on the one hand, a handicap which is scarcely appreciable, and, on the other, a threat of impending dissolution. The task of the physician is to determine at what position in the scale the individual case should be placed: on a just estimate may depend the making or the marring of the patient's career, the happiness of his family, and the reputation of his doctor.

With reference to congenital murmurs unattended with cyanosis, the probability is that the subjects will grow up; their education should be pursued on the usual lines; it will be time enough to limit their studies or games when dyspnea, delayed development or cyanosis appears. Even in cases where the evidence of congenital defects is most patent, life and activity may be pro-

longed to a surprising degree.

The decision with reference to a murmur discovered in the course of acute rheumatism must be deferred till the temperature and the joints have been normal for some weeks. If at that time the heart is manifestly enlarged and the pulse is rapid, the outlook is bad, and the heart will be permanently crippled. In a child, growth will be retarded, and life will hardly be prolonged many years. If, however, though the murmur remains, there is no marked enlargement of the heart, and the pulse is slow and regular, the case comes into the category of stationary established lesions, evidenced by the presence of a murmur.

The cases that the physician continues to watch are those which become chronic invalids or who die early. Hence he is likely to take a graver view of the prognosis in valvular disease than a complete knowledge of the

facts would demand.

Bradshaw has studied the histories of 127 cases—57 men and 70 women—with a view of learning the length of time between the initial damage to the heart and the onset of failure of compensation such as to necessitate the cessation of work. Nearly one-half enjoy freedom

from serious symptoms for fifteen years after the initial lesion. In men the chief incidence is in the first twelve years; in women there is tendency to postponement. Half of the men may be expected not to break down under 12 years, half of the women break down between the 9th and the 21st year. The chance of escape for the average period of fifteen years is about the same in both sexes. Aortic cases are particularly liable to show failing compensation during the first few years: if they do not they are just as likely as mitral cases to maintain full compensation for many years. As regards the age at which compensation is likely to fail, in about one-half of the cases the first breakdown occurred before the age of 31. This held in both sexes. In aortic disease there is a tendency for the cases to fall into two groups, the failure of compensation tending to appear either at the beginning of adult life or well on in middle age. Out of the whole series of cases believed to have originated before the degenerative period, 16-13 per cent.—reached the age of 48 or upwards before a break-Without pressing statistics unduly, down occurred. they show at least that the existence of valvular defects in early life, and even in middle age, is compatible with the continuance of life for many years, with the enjoyment of fair health and the exercise of considerable activity.

The immediate cause of the failure of compensation is not generally apparent. The most frequent antecedent is dyspnea on exertion, dating back for months or years, beginning perhaps after some acute illness or accident, but more often not referred to any definite period. A time of stress, such as nursing a sick relative, or taking up a new occupation involving unusual exertion, may determine a breakdown. Thus a young man, a valet, remained free from cardiac symptoms for nearly six years after rheumatism, but began to suffer soon after he went out on the moors with his master, carrying a gun. The most frequent event which seemed to determine the onset of dyspnea, or the actual breakdown, was an intercurrent attack of rheumatism.

The influence of pregnancy and parturition are less marked than usually supposed.

Cardiac Murmurs in Gall-Stone Disease. D. Riesman<sup>4</sup> reports recent examples of heart murmurs in connection with gall-stone disease, a condition which he noted some years ago and which has since been confirmed by Babcock, Mayo and others. He found these murmurs present in 6 out of 56 cases, and believes that the percentage would be found much greater if all cases were examined at the time of an attack. In 5 cases examination before the attack had shown the absence of a mur-The murmur is not to be attributed to endocarditis or jaundice, but is probably due to myocardial weakness, which produces relative insufficiency of the mitral valve. The murmurs disappeared after operation, indicating the causal effect of the gall-stone dis-The presence of a murmur is not to be regarded as a contra-indication to operative interference, but rather as a reason for removing the cause before the myocardial degeneration has advanced too far. author thinks that the murmur might be of diagnostic significance in cases of repeated attacks of epigastric pain of an obscure nature in which angina pectoris and the crises of tabes have been ruled out, the existence of a murmur suggesting the probable presence of gallstone disease.

### AORTIC INSUFFICIENCY.

W. W. Kerr<sup>5</sup> discusses aortic regurgitation.

Factors Influencing the Momentum of the Regurgitant Stream. During diastole a stream of blood flows backward from the aorta into the ventricle with a momentum resulting from a number of factors, none of which are constant. 1. Gravity must depend upon the position of the patient. 2. The recoil of the aorta, the walls of which have been stretched during systole, will naturally vary with the volume and force with which the ventricular contents have been propelled into the aorta, the condition of the aortic wall, and the degree of contraction in the peripheral vessels. 3. The ventricular suction

<sup>(4)</sup> Amer. Jour. Med. Sciences, November, 1911. (5) Amer. Jour. Med. Sciences, October, 1911.

at the commencement of diastole is only of momentary duration and corresponds to the elastic recoil or relaxation of the myocardium. In feeble cardiac contraction this negative pressure may be entirely absent. 4. The effects of this stream will also be influenced by the area of the regurgitating column of blood; that is, by the size of the aperture of incompetence.

The Distribution of the Diastolic Murmur and Conditions Influencing It. This depends upon the direction of the regurgitant stream, which is modified by the nature of the valvular lesion and also by the force of the current; but both of these have to be considered in relation to the anatomic formation of different parts of the ventricular walls, as well as in connection with the fact that the blending of the aortic regurgitant stream with that entering through the auriculo-ventricular orifice is liable to produce vibrations within the ventricle that are communicated to the cardiac wall, and thence to the chest wall and ear of the auscultator.

The diastolic murmur which accompanies this condition is recognized by most clinicians to be the most erratic of all cardiac murmurs in its area of distribution. The maximum intensity is most frequently not in the so-called aortic area, but over the left half of the sternum at the level of the third interspace or upper border of the fourth costal cartilage, or it may be over the right side of the sternum at the level of the third interspace, or at the apex and only at the apex. Furthermore, the distribution is not always the same from day to day in the same patient. The location of the murmurs is influenced by the segment of the valve affected, but this again is modified by the irregularity of the opening and by the presence of vegetations or roughened surfaces of the valve. Again, variations in the area of distribution of the murmur in the same patient from day to day, apart from those cases of acute endocarditis, where the inflammatory process is continually changing, are probably due to variations in aortic pressure. The distribution of the murmur is also influenced by the position of the membranous interventricular septum, and by the fact that the murmur is produced not only by the vibrating valves but also by currents in the fluid contents of the ventricle which send vibrations to the walls of the heart.

Among other matters of interest in the study of cases of aortic regurgitation are the changes that take place in the left ventricle and auricle. These are frequently discussed as if the enlargement of the ventricle were due to pressure from the volume and force of the aortic regurgitant stream, and the auricular increase were the result of a compensatory effort consequent upon failure of the left ventricle. But it is probable that the changes in the left auricle and ventricle take place simultaneously and that the left auricle is responsible to a very great extent for the dilatation of the left ventricle.

The increased capacity of the left ventricle is the result of a forcible dilatation, owing to the regurgitant stream entering under pressure at a time when the ventricular walls are relaxed and the blood is simultaneously pouring forward through the auriculo-ventricular orifice, so that when the auricular systole is due it finds that it has to discharge its contents into a ventricle which is already better filled than it should be at this period of the cardiac cycle. Consequently, the ventricle must dilate that it may accommodate the additional quantity of blood, or the auricle itself must yield under the strain. Fortunately, the reserve capacity and power of the left ventricle is considerable, so that in very many cases its elasticity permits an increased capacity without the infliction of any injury to the muscle fibers, and the reserve force is sufficiently great to discharge the increased volume of blood into the aorta with each systole, and thereby maintain compensation. In accordance with physiologic laws, the cardiac muscle should hypertrophy in response to this increased amount of work, but this process, which is a gradual one compared with that of dilatation, will take place only if the coronary circulation is adequate to supply the demands for increased nutrition, and if the patient's habits are so regulated that he lives well within the working capacity of his heart and allows time for additional

muscular growth before attempting any exertion. cases of the cardiac variety, occurring in young people, it not infrequently happens that perfect compensatory hypertrophy takes place, the increased capacity being sufficiently great to accommodate the additional quantity of blood, and the hypertrophy strong enough to discharge it into the aorta. Such compensation, however, demands (1) that the coronary arteries shall be healthy, hence it is nearly always impossible in the arteriosclerotic variety; (2) that the amount of regurgitation shall be small, because a large amount of regurgi--tation must quickly lower the aortic pressure and thus interfere with the proper filling of the coronary vessels; (3) that the heart shall not be subjected to any strain while the compensatory hypertrophy is develop-It must not be forgotten that the left auricle participates in producing and maintaining compensation even at this time.

The changes in the left auricle take place simultaneously with those in the ventricle and are not secondary to ventricular failure. The left auricle from the very first has a tendency to hypertrophy in accordance with the physiologic law that muscles hypertrophy under increased work, but, of course, the degree of hypertrophy will vary with the amount of work imposed and the capacity for increased nutrition. Kerr believes that it is a mistake to regard the auricular changes as a result of failure of ventricular compensation. The auricle and the ventricle must suffer together, and when the latter begins to fail from lack of adequate coronary circulation, so will the former. The hemoptysis which frequently occurs is evidence of the increased pressure in the pulmonary circulation due to obstacles which the left auricle must overcome.

Arguing from such premises, it would seem reasonable to conclude that compensation for any degree of aortic incompetence from its very commencement depends upon the capacity of the left auricle and ventricle to undergo hypertrophy. But compensation may never take place either because the amount of regurgitation is beyond the combined powers of auricle and ventricle

from the very commencement, or the patient is not kept at rest for a sufficient length of time to permit the growth of the necessary muscular tissues, or the condition of the myocardium and coronary vessels may be such as to make hypertrophy impossible. This is especially the case in the arterial variety of aortic incompetence, as this pathologic lesion is very liable to be associated with atheroma of the coronary arteries or some other degenerative changes.

It must be borne in mind that in almost every instance, even when the most satisfactory compensation exists, it is only a matter of time until failure will occur, and one cannot help being impressed with the rapidity with which failure progresses when the downward process has once commenced; yet the reason is not far to seek. The continual increase of muscular tissue ultimately puts the myocardium beyond the nutritive power of the coronary vessels, especially in the arterial variety of incompetence. Even in the majority of endocarditic cases the coronary vessels have been taxed to their fullest capacity, and, as the degenerative changes consequent upon the increasing years of the patient are superadded to the original lesion, it is natural that failure should take place rapidly.

Experimental work done by Stewart showed hypertrophy of the whole heart, but chiefly of the left ventricle and the auricles. More experiments showed another matter of special interest in regard to treatment, namely, "the remarkable rapidity with which the heart hypertrophies after the production of aortic insufficiency. This hypertrophy is well established after one week, and at the end of five days there is sufficient evidence to show that even the enlargement is in progress." We must remember that Stewart was working with normal heart muscles, and that clinically, where one is so frequently dealing with a coexistence of aortic incompetence and myocarditis, the extent of injury to the left ventricle must vary, but this does not in the least invalidate his conclusions.

Such considerations should not be regarded simply as medical sophistries of no practical importance; on the contrary, they explain many clinical points and afford the indications for treatment. A thorough appreciation of the manner in which compensation is established and maintained, together with a recognition of the difficulty of restoring compensation when it has been lost, can only be obtained from a perfect knowledge of the cardiac mechanism and the manner in which it is liable to suffer under various abnormal conditions.

It is a fact that in many instances aortic lesions are regarded too lightly at their inception, and a patient allowed to resume active duties before there has been time for sufficient compensatory hypertrophy to develop, with the result that the mitral orifice becomes incompetent, and this is much harder to overcome when associated with an aortic lesion than when it occurs alone. Clinicians will generally admit this to be the case, and it is not difficult to find the explanation. Cases of muscular mitral incompetence can be relieved only by resting the heart and improving its nutrition, and success in the latter direction depends upon the possibility of restoring and maintaining an adequate circulation through the myocardium itself. To attain this end a rise in aortic pressure must be obtained, because this is one of the chief factors in determining the flow of blood through the coronary arteries; but the constricted aortic orifice, by diminishing the volume of blood entering the aorta, or the incompetent valves which allow the blood to escape, present obstacles to the production and maintenance of normal aortic blood-pressure which do not exist in the uncomplicated mitral lesion.

## MITRAL STENOSIS.

Presystolic Murmur. In 1843 Fauvel described the presystolic murmur and advanced the view that it was due to abnormal blood-currents caused by obstructions at the mitral orifice during the systole of the auricle. A few years later Gairdner supported this view with much force and originality. Since Gairdner's time clinicians have been practically agreed that this short, rough, crescendo murmur, terminating with the first sound of the heart and usually audible over a very limited area near the apex, is indicative of mitral stenosis,

but the forces which are active in its causation have been the subject of extensive controversy. Ormerod claimed that the musculature of the auricle was not powerful enough to produce a murmur of the character of the presystolic, and Barclay put forward the view that the murmur was systolic in time and was caused by a portion of the ventricular contraction which preceded the first sound. These views have been further amplified by Dickinson, Brockbank and others.

T. Stuart Hart has noted the fact that in certain cases with evident mitral stenosis, with well-marked presystolic thrill, and presystolic murmur at the apex, the jugular pulse was of the ventricular type, the tracings conforming in detail to the type designated by Mackenzie as the "nodal rhythm." In some of these the mitral valve only was affected, in others there was either a certainty or a suspicion of an aortic insufficiency

complicating the picture of pure mitral disease.

Hart presents in detail four cases with well-marked clinical signs of mitral stenosis, and has records of a number of others which could be included in this group. The physical signs in all of these cases have been verified by other competent observers. In two of these cases the presence of a diastolic murmur might suggest the presence of an associated aortic insufficiency, but it is reasonably assured that we are dealing in all of these cases with mitral lesions only. At no time during the observation of these cases was there an absence of the so-called presystolic thrill and presystolic murmur. Many graphic records of these cases were secured; they invariably exhibited complete irregularity, the ventricular form of venous pulse and an entire absence of evidence of gross auricular contraction.

The conclusion is obvious that, in certain cases at least, the short crescendo murmur preceding the first sound in mitral stenosis is not due to auricular activity.

TRICUSPID VALVULAR DISEASE.

Tricuspid Defects.- H. Stern<sup>7</sup> describes a method of examination for defects of the tricuspid valve which he

 <sup>(6)</sup> Med. Record, July 1, 1911.
 (7) Berlin. klin. Wochenschr., July 17, 1911.

says enables one to hear the murmur connected with tricuspid disease at any time if it has once been heard. This consists in placing the patient in the Trendelenburg position, with the head hanging over the end of the table. In this position the defect in the valve is made more prominent, or a stenosis becomes more marked. The pulse in the hepatic vein, which is a characteristic phenomenon of tricuspid insufficiency, but is rarely observed, he has been able to find seven times in the last sixteen months. Naturally the position cannot be tolerated by the patient for any length of time, and therefore the physician should always be ready to make the examination as soon as possible after the patient is in the proper position.

Tricuspid Stenosis. Tricuspid stenosis is a comparatively rare lesion. According to T. B. Futcher, up to 1908 only 187 cases had been reported, and since then two others, in addition to which he reports five. In only thirteen cases has a correct antemortem diagnosis been made. It is evident therefore that the recognition of the disease is not easy. Among 26,000 medical admissions to the Johns Hopkins Hospital there have been only eight cases in which there was either a clinical or post-mortem diagnosis of tricuspid stenosis. In only five cases has the lesion been found post-mortem out of a total of 3,500 autopsies. In only one of these five cases was a correct diagnosis made during life. The author summarizes as follows the five cases which he reports:

All were females. Their respective ages were 37, 35, 35, 36 and 29 years. There was a definite history of rheumatism in 3, one of these also having chorea. The etiologic factors were not clear in the other two. It is possible that there may have been a congenital element in one. In all 5 there was a marked mitral stenosis lesion. In 3 of the 5 there was a definite aortic stenosis. In the fourth there was thought to be some aortic narrowing. In the fifth case the aortic valves were normal. In all 5 the pulmonic valves were unaffected.

<sup>(8)</sup> Amer. Jour. Med. Sciences, November, 1911.

Futcher gives the following account of the disease: Etiology. Undoubtedly tricuspid stenosis is often due to endocarditis following rheumatism, or some other acute infection. The fact that it is almost invariably accompanied by lesions of the mitral or aortic valves confirms this view. Osler states that congenital cases This is supported by the opinion are not uncommon. of other observers. These are usually accompanied by some other defect. The absence of any rheumatic history and the existence of a generalized narrowing of the whole aorta would suggest very strongly that the stenosis in Case I may have been congenital in origin. Congenitally defective valves are undoubtedly very liable. to postnatal endocarditis.

Symptoms. The conspicuous symptom is the extreme cyanosis in the majority of cases. This is due to the marked venous stasis resulting from the tricuspid narrowing. Occasionally it has been absent, as in Shattuck's case. Otherwise there is nothing characteristic. Dyspnea may be extreme when broken compensation, due to over-dilatation of the right auricle, supervenes. It is surprising with what degree of comfort these cases are enabled to go about for years. This is probably due to the fact that the narrowed auriculo-ventricular orifice lessens the engorgement of the pulmonary circulation and the consequent dyspnea. In the terminal stages of the disease, dyspnea may become extreme, even on the slightest exertion. Cough, general anasarca and effusion into the serous sacs also supervene.

Physical Signs. I. Inspection. 1. A presystolic pulsation may be observed in the jugular veins and in the markedly enlarged liver if the case is seen when the right auricle is still compensating. With the striking tricuspid narrowing so often seen, the right auricle is not able to empty itself readily, and there is a consequent wave transmitted backward into the near-by venous trunks. This sign disappears in many of the cases with decompensation, as the auricular contraction is too weak to give rise to a reflux wave during auricular systole. 2. Precordial inspection reveals nothing char-

acteristic. 3. Mackenzie considers a presystolic pulsa-

tion of the liver an important sign.

II. Palpation. 1. The radial pulse is nearly always extremely small in volume, owing to the over-engorgement of the venous and the impoverishment of the arterial systems. Frequently it cannot be counted, and it is irregular in force and rhythm and of low tension.

2. A presystolic thrill may be, but rarely is, felt at the tricuspid area. It is often difficult to differentiate such a thrill from the accompanying thrill of mitral stenosis.

3. The systolic shock may be marked over the tricuspid area and was of value in arriving at a diagnosis in Case I. In this instance the exaggerated systolic tap was present at the mitral area, but was even more marked at the tricuspid.

III. Percussion. The distinguishing feature is increase in the area of cardiac dullness toward the right,

especially in the region of the right auricle.

IV. Auscultation. 1. When a rumbling, presystolic murmur is audible over the lower sternal region and particularly toward the right border, it is of great value in helping to arrive at a diagnosis. Very frequently the murmur is absent owing to the weak action of the right auricle in the stage of decompensation. 2. The first sound may be snapping at the tricuspid area. sign, together with the exaggerated systolic shock and extreme cyanosis, were the three which chiefly led to the diagnosis in Case I. There was no presystolic murmur at the tricuspid area. 3. The second pulmonic sound is usually said to be enfeebled. This is not always the case, however, as it may be accentuated. 4. Mackenzie has pointed out that the right auricle may become so greatly hypertrophied that it sends back a large wave into the jugular vein with such force that it causes the valves in the jugular and subclavian veins to close with a snap, which he was able to hear over these veins as a clear, sharp sound preceding the first sound.

Tricuspid Regurgitation. O. Moon' reports a case of tricuspid regurgitation unaccompanied by disease of

<sup>(9)</sup> Lancet, Nov. 25, 1911.

the mitral, pulmonary or aortic valve, this diagnosis being confirmed by necropsy. The patient was a boy, aged five years, who had had measles and diphtheria and had been weak for the two years following the diphtheritic attack. Finding the mitral valve normal came as a surprise to the author; the fact that the systolic murmur was plainly heard at the back is generally held to be against the purely tricuspid origin of it; then, again, the accentuated pulmonary second sound seemed to point to the mitral lesion, but in children no doubt one cannot attach much importance to these signs. On the other hand, there was no cough or dyspnea, and the comparative absence of edema from the lungs was in striking contrast to the general anasarca. The cantering sound in the tricuspid area, which usually points to an abnormal blood-pressure in the right ventricle, ought, perhaps, to have given the clue to a correct diagnosis.

#### TUMORS OF THE HEART.

L. Ehrenberg¹ reports two cases of tumor of the heart, the first being a polypous sarcoma in the right auricle, with an infiltrating obstructive sarcoma in the superior vena cava, the anonymous vein and the azygos, and the second a metastatic carcinoma in the right ventricle. He formulates the following conclusions:

1. Primary sarcomata in the cardiovascular system are localized as a rule in the right half of the heart, especially in the auricle and the large vein near to the heart. Primary sarcomata of the heart are distinguished by this circumstance from other primary tumors of the heart, for which the left side of the heart is the place of predilection.

2. A relatively large number of primary sarcomata in the heart and the large veins are giant-celled sarco-

mata (five of the known twenty cases).

3. Symptoms of stagnation in the area of one of the large veins are rarely observed with a tumor in the right auricle. Such a symptom arouses a suspicion of a tumor-like process outside of the heart.

4. Abnormally large movements of the wall of the

<sup>(1)</sup> Deutsch. Archiv. f. klip. Med., July, 1911.

right auricle, as shown by the x-ray, may possibly be of

value for the diagnosis of such cases.

5. A considerable tumor in the right ventricle may, by causing a stenosis of the tricuspid opening, lead to a condition of extremely small pulse for a period of days, while narrowing of the conus arteriosus presumably may give rise to a systolic murmur at the pulmonary orifice.

#### SYPHILIS OF HEART AND BLOOD-VESSELS.

Diagnosis and Treatment. According to G. Richter<sup>2</sup> the treatment in most cases of syphilis of the heart and blood-vessels cannot be simply a specific one, as we have to combat certain conditions which are not amenable to it, namely, secondary mechanical and other disturbances of the circulation. Syphilis causes an exudative inflammation with a predominance of changes in the blood-vessels, while a later, though at times still early appearing stage, exhibits the formation of the so-called gumma. The latter is as characteristic of syphilis as the tubercle is of tuberculosis.

Arteriosclerosis, on the other hand, is a condition distinct from lues. To understand this well we must recapitulate the normal structure of vessels, avoiding details. Capillaries consist of tubes of a single layer of endothelial cells. To them is added in the next larger vessels an adventitia or tunica externa, a membrane formed by a fibrous connective tissue.

Another affection, and one of vastly greater importance, is mesarteritis productiva, or inflammation of the tunica media or muscularis: the ordinary form of specific syphilitic inflammation of vessels. Mesarteritis productiva syphilitica occurs in all vessels, but its seat of predilection is the aorta at or near the heart, in an average about one and a half inches above the semilunar valves, called mesaortitis. The valves are usually not involved, but the coronary arteries frequently suffer from secondary conditions resulting from aortic changes, from retractions and partial occlusion, to which an obliterating arteritis of the coronary vessels may be added. Deep scars result, star-shaped with a thinned wall offer-

<sup>(2)</sup> Med, Record, Oct. 5, 1912,

ing lessened resistance to blood-pressure and giving rise to aneurism. Or, in other cases, flat plaques, slightly raised with fine folds covering the surface, or thick fibrous patches are seen. They may extend down to the thoracic aorta; often they remain isolated and small. They are quite characteristic, since the endothelium is not directly involved, occur with preference in younger persons, and cannot be mistaken for arteriosclerotic processes. The mesaortitis syphilitica may be further characterized by the presence of gummata. In purely syphilitic cases the intima is never implicated primarily in the process.

We must distinguish between three separate conditions: 1. Senile arteriosclerosis, apt to appear before its legitimate time, as a condition of the aging intima; it may involve the media and occasion the formation of an aneurism. 2. The infectious types attacking the media first, bacterial or toxic in origin; they also lead frequently to atheromatosis and aneurism. 3. Lastly, syphilitic arteritis, in a class by itself, a disease of the media, extending to the adventitia and eventually, but not necessarily, implicating the intima. Prompt recognition of the etiology has repeatedly resulted in a cure or marked alleviation of the condition.

Analogous are the findings in syphilis of the heart. Here also we must distinguish between senile arteriosclerosis affecting the intima—here called endocardium—and syphilitic myocarditis, corresponding to the gummous or diffuse infiltration of the tunica media—here the heart muscle itself—and finally the adventitia or the epicardium (pericardium). In other words, what has been said of endarteritis and of mesarteritis applies also to the heart.

Of much greater importance is, of course, the ordinary endocarditis of which a warty or verrucous and an ulcerating form are described. They are extremely frequent in inflammatory rheumatism and occur also after various infections of other character, like gonorrhea and sepsis. But it must be noted that there is no true isolated endocarditis syphilitica, neither a verrucous nor an ulcerating form. Destruction or impair-

ment of the valves in syphilis is extremely rare and due to primary affections of the myocardium continuing into the endocardium and involving the valves secondarily, or also due to mesaortitis extending to the valves. Of greatest rarity is aortic stenosis in syphilis. Much more frequent is a regurgitation consequent upon a dilatation of the aortic ostium, after dilatation of the heart itself as produced by myocarditis syphilitica.

An isolated aortic regurgitation is almost always syphilitic. It is occasionally associated with tabes or

progressive paresis.

Diffuse luetic myocarditis belongs to the rarities, as also gumma of the heart muscle. In some cases a gumma has involved the bundle of His, the Tawara node, or the venous sinus, each leading to impairment of conduction of the stimulus and consequent heart-block or Stokes-Adams syndrome, while myocarditis weakens the contractility.

On the epicardium we find gummata, diffuse inflammations due to them, and white patches. The latter are certainly not due to gumma or syphilis. The syphilitic epicardiac process is always continued from myocarditic disease. Aneurism of the heart has also been observed in syphilis.

The clinical symptoms are caused principally by loss of elasticity of some part of the vascular apparatus, either focal or widespread. Thus originate aneurisms and arteriosclerosis. Or they may occur in consequence of arteritis obliterans, occlusion of an artery with consequent thrombosis, malnutrition, necrosis of corresponding tissues. Or a gumma may form a mechanical obstacle. Or, finally, retractions from scars left from destructive processes may interfere with normal functions. And, as is practically the ease in all diseases, hampered functions awaken our attention.

'The circulation of the blood is sustained not only by the rhythmic contractions of the heart, but also by the activity of the arterial mechanism. This causes the general arterial luctic disease to bring extra work upon

the heart and hasten its degeneration.

The relations between arterial tension and heart pres-

sure are most manifold. Many ignore the fact that peripheral pressure, as measured on the radial artery, and pressure within the viscera rarely correspond. And, furthermore, arterial tension as felt with the examining finger, due to active contraction of the arterial wall over the flowing column of blood and clearly proven by the sphygmogram, may accompany high or low pressure due to the energy of the contracting heart muscle and vice versa.

Luetic arteriosclerosis shows a widely different aspect. Occlusion of peripheral vessels is caused in the senile form rather by thrombosis, in lues by an arteritis obliterans, in other cases again by a spastic condition localized in arteries of the extremities (as in Raynaud's disease and in many cases of diabetes); then one may observe sudden temporary limping, claudicatio intermittens. Many draw a parallel between this and certain phenomena in heart action referred to temporary spasm of coronary vessels and of intestinal vessels, the so-called abdominal asthma. Lues is the cause of many cases of angina pectoris.

While the arteriosclerotic may have many premonitions of his circulatory condition, it is usually different from the luctic. He is perhaps not aware of anything being wrong. He uses and abuses his system in his accustomed way, and will not mind an occasional palpitation or fluttering of the heart. But quite suddenly. for some not always explicable reason, the heart breaks down. It has used up all its reserve capital and fails a sudden pang, a sensation of missed beats, perpetual irregularity of the pulse, a violent pain in the region of the heart, perhaps extending down the inner side of the left arm (Mackenzie), a sinking sensation, an unaccountable terror, syncope, Cheyne-Stokes respiration, Adams-Stokes syndrome, cold sweat; a rapidly rising blood-pressure, at least at first; the patient gasps, his face becomes livid or pale, profuse perspiration sets in. All or many of these symptoms produce a picture of suffering than which there seems none more heartrending. Gradually the attack subsides, the sufferer feels most welcome relief. Such spells are brought on either by an unusual exercise, an exposure to cold, a psychic adventure—anything which causes contraction of a large territory of capillaries and thereby suddenly increases heart action beyond its now inadequate adaptability and capacity for work.

Stealthily the incompetence of the heart becomes more permanent; lung congestion (weakness of the right ventricle) produces dyspnea and cardiac asthma; edema of the dependent parts is established, swelling of the liver embarrasses the abdomen, only a sitting posture

allows a shadow of comfort.

It is particular cardiosclerosis following myocarditis syphilitica which causes such havoc. Involvement of the organs of conduction of stimulus within the heart produces bradycardia, tachycardia and frightens patient and attendants. Continuous irregularity of the pulse demoralizes circulation. The patient at last lies listlessly in his bed, or in a half-stupor, unless a sudden attack of cardiac asthma arouses him from his lethargy to renewed and increased suffering. Daily we expect to hear of his demise—but he lingers on, he begins to breathe easier, his appetite returns, he ventures out of his bed. He recovers more strength and returns to a life of renewed activity.

The diagnosis of syphilis of the heart and bloodvessels must be based on the same grounds which serve us in diagnosing other syphilitic manifestations. syphilitic heart and blood-vessels show clinically nothing absolutely characteristic. Our suspicion will be aroused when the patient is below the age of senile arteriosclerosis, when the involvement is essentially an aortic incompetency, when the symptoms supervene rather suddenly and are not accompanied by fever, thus excluding acute endocarditis from any other cause. The Wassermann and the luctin tests will show that syphilis is much oftener present in such diseases than has been surmised heretofore. It only remains to be stated that in such cases other evidences of syphilis, tertiary symptoms in general, are almost always absent, and that the first symptoms may occur as late as thirty or more years after infection and an uninterrupted general health.

But there are two other sides to the question after the presence of syphilis in the patient has been proven. Are the symptoms really due to syphilis or to other complicating causes, like rheumatic endocarditis, or other toxemia, or premature arteriosclerosis? Here the art of the physician, not to say his instinct, may guide him better than laboratory methods.

And, again, are the symptoms due to an active syphilis or are they the result of a previous and now terminated syphilitic process as encountered in tabes and in general paresis? Here a most careful analysis of all the symp-

toms may help us out of the darkness.

The prognosis is not absolutely bad; it depends, of course, upon the extent and the importance of the parts involved. A reparation is not rare, while it is impossible in senile arteriosclerosis.

As to treatment, nothing new can be advanced. Specific treatment is in most cases helpful. Why Ehrlich cautions against the administration of salvarsan is not quite clear. It has been given by many with excellent results. Digitalis and other bodies of the digitalis group. often disappoint, though good preparations of strophanthus (however, difficult to obtain) seem to be quite serviceable. Iodids seldom fail to benefit the patient, which may be partly due to their diminishing the viscosity of the blood and rendering the work of the heart so much easier. Intravenous medication (digalen. digipuratum, strophanthin-Böhringer) gives in appropriate cases decidedly better and often astounding results. Hypodermics of camphor or caffeine will tide over a dangerous phase. Nitrites in angina and hypodermics of adrenalin or of pituitrin are rapid in action and comparatively harmless, but the effect will not last and frequent repetition may be called for. The latter two are particularly helpful in cardiac asthma. Strychnine is, of course, a great stimulant, but has no direct effect upon the heart (Mackenzie).

In all other respects the management of such cases will have to be guided by the rather erratic rules governing treatment of vascular diseases in general. A close supervision of all the functions of the organism, careful

regulation of the diet, a proper weighing of rest and exercise promise altogether better results than routine prescriptions and measures. Physical therapy is perhaps the most beneficial of all, but difficult to apply properly. Sweating and purging in edema exhaust the weak and hasten collapse—heart failure! A salt-free diet and restriction of liquids are more satisfactory (Karrel diet).

#### TUBERCULOSIS OF THE HEART.

W. J. McKeand and McKinlay Reid<sup>3</sup> report a case of large caseous tubercle of the myocardium. Tuberculosis of the myocardium as a secondary affection in general tuberculosis is not so uncommon as one is led to believe, but a large caseous tubercle is seldom met with in the post-mortem room. Kaufman, in his text-book, speaks of it as rare, and Babcock, in Osler and Macrae's System of Medicine, as exceedingly rare. Albutt. Nothnagel. Hektoen and Coats all regard it in like fash-The ventricles are considered more frequently affected than the auricles, and of the former the left chamber oftener than the right. In the case here recorded the auricles appeared to the naked eye uninvolved, and the process was more or less equally distributed throughout the walls of both lower cavities. Occasionally secondary tuberculosis of the heart may result by direct extension from adjacent parts or by lymphatic spread. In this it was fairly clear, notwithstanding the involvement of mediastinal glands and pericardium, that infection had occurred per sanguinem.

The patient, aged 24, suffering from dementia precox, entered the asylum in fair bodily health; her lungs were sound and her cardiac dulness normal; there was slight accentuation of the second aortic sounds. Before admission she was said to have had fainting attacks and to have suffered from coldness and blueness of the extremities. The physical condition appears to have remained unaltered for some time. She died from phthisis complicated by the heart affection, peritonitis and ascites.

Aside from the tuberculous changes in the lungs, there

<sup>(3)</sup> Lancet, Sept. 7, 1912.

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was found embedded in the anterior wall of the right ventricle a caseous mass  $1\frac{1}{4}$  inches in length and about 1 inch in depth; it was quite firm to the touch and was surrounded by a thin band of fibrous tissue. Towards the apex of the heart, and separated from this mass by a strand of muscle, was a deposit of similar appearance and of the size of a hazel-nut. In the anterior wall of the left ventricle were two other masses practically converging, but well defined from the surrounding muscle by a fibrous zone; one of these was  $\frac{1}{2}$  inch in diameter and circular, the other somewhat smaller. The mitral valve admitted two fingers and was of normal structure. The aorta showed a few isolated patches of thickening.

G. C. Low reports a case of tuberculosis with special involvement of the heart which presented during life evident signs of pulmonary tuberculosis with a murmur at the base of the heart not transmitted. The necropsy showed moderately advanced pulmonary tuberculosis, miliary tuberculosis of the pleura, and disseminated tuberculosis of other organs. The left ventricle, perhaps more so than the other chambers of the heart. was greatly diminished in size owing to an enormous, more or less concentric, hypertrophy of the ventricular wall. The myocardium showed an extraordinary appearance, being infiltrated, or rather replaced, by caseous, cheesy masses of different sizes, these having produced the nodular or marble-like lumps seen on the outside of the heart during the necropsy. The wall at the base of the ventricle measured no less than 13/4 inches in thickness, this gradually tapering to 3/4 inch at the apex. Practically no normal muscular tissue was left, the tuberculous lesions having entirely replaced this.

The right ventricle and both auricles were also affected, the cavity of the left auricle especially being surrounded and infiltrated by tuberculous masses and thereby greatly obliterated. Remains of pericardium adherent and firmly bound to the auricles and great vessels at the base were easily found, but the pericardial membrane was, on the whole, quite free from tubercu-

lous changes.

<sup>(4)</sup> Lancet, Feb. 10, 1912.

The case furnishes an excellent example of a tuberculous myocarditis, and with such advanced caseous masses replacing almost entirely the whole muscular substance of the heart it is extraordinary how life could have been prolonged as long as it was. The caseation and cheese-like masses were quite typical of tubercle, but to make absolutely certain of this, sections were cut both of these and the lesions in other parts of the body. Histologically they showed typical tuberculous lesions, and by Ziehl-Nielsen's method tubercle bacilli were detected in large numbers in the material taken from the heart.

# DISEASES OF THE BLOOD-VESSELS

#### PHYSIOLOGY.

Reversal of Circulation. M. Rothmann<sup>5</sup> sums up the results of investigations to determine whether it is possible to reverse the current in the arteries and veins of a limb with the following conclusions:

Areas of the circulation whose veins are provided with sufficient valves offer an absolute resistance to a backward movement of the blood. Areas of vessels without valves which possess only one efferent vein permit a reversal of the blood-current; still it appears that only a part of the mass of liquid which passes into the veins is returned in the arteries, while at the same time a

marked edema of the perfused organ occurs.

In the case of areas of vessels without valves from which only a single one is used for the introduction of a backward stream a large degree of reversal of the circulation is possible, because a part of the liquid passes actually through the capillaries and arteries in the retrograde direction. The principal part, however, uses the anastomoses of the veins, which present a much slighter resistance for the outflow. As the amounts of liquid which flow back by these two channels are inversely proportional to the resistances in the respective channels, it must happen that practically the entire liquid flows not through the capillaries and arteries but through the venous anastomoses and the veins which are left free.

#### ARTERIOSCLEROSIS.

Etiology. S. Saltykow<sup>e</sup> sums up as follows the results of a review of the causation of arteriosclerosis.

<sup>(5)</sup> Berlin, klin. Wochenschr., May 20, 1912.
(6) Correspondenz-Bl. f. Schweiz. Aerzte, Sept. 20, 1911.

Arteriosclerosis is chiefly produced by infectious proc-The species of micro-organism concerned has no importance, as is shown by animal experiment. In the second place are chemical poisons, especially alcohol, which is only an extension of the toxic theory of arteriosclerosis, since there is no fundamental difference between the action of the toxins of bacteria and that of The author is not disposed to deny that certain mechanical relations in the arterial system may be of importance for the origin of arteriosclerosis, but in his opinion these play at most a secondary rôle as predisposing factors. Moreover, it seems impossible to conceive that the overexertion of the arterial system can produce by itself alone this complicated disease occurring in various foci. But above all, arteriosclerosis is not a disease of age; this designation has at the most only a certain justification from the clinical standpoint, because, since it is effective as a rule by a summation of injurious factors, clinically demonstrable symptoms are first occasioned in advanced age. Their beginning, however, is to be sought in youth, or even in childhood, and from this pathogenetic standpoint it would be more proper to speak of arteriosclerosis as a juvenile disease.

Worry as an Etiologic Factor. H. C. Clapp' discusses the importance of worry as a cause of arteriosclerosis. While syphilis may be accorded a place among the causes of arterial degeneration, Clapp believes its importance has been overrated, and he would place overeating as probably the most common. The emotions, however, are especially fruitful in causing changes in the caliber of the blood-vessels and eventually causing them to wear out. Among the emotions, worry takes first place because its action is more frequent, long-con-

tinued and effective than any other.

[The vascular changes in worry are doubtless similar to those produced by the related emotion fear. Fear we know causes accumulation of blood in the splanchnic vessels, a contraction of vessels in the periphery, and a resulting burden on the heart. That this condition is brought about in some cases by physical causes is shown

<sup>(7)</sup> Med. Record, Sept. 21, 1912.

by cases in which a causeless dread affects the patient from pathologic causes. The fear of impending death felt by patients with angina pectoris appears to be due to the condition of the circulation, and not to primary mental causes. The idea easily suggests itself that worry itself may be the mental response to a changed condition of the circulation in consequence of toxemia or other physical cause. Undoubtedly the mental condition thus set up greatly aggravates the circulatory disorder and by its perpetuation supplies the constant irritation which may lead to permanent arterial degeneration.—S.1

Treatment of Arterial Hypertension. In considering the dietetic and hygienic treatment of hypertension, A. E. Elliotts calls attention to the need of deciding in the individual case whether attempts should be made to lower the high blood-pressure. High blood-pressure may be necessary for the proper performance of the heart action and it may not be the cause of the symptoms complained of. Attempts to control high blood-pressure should be guided by conservatism, and the means employed should be indirect rather than direct. Even in matters of diet and hygiene it is possible greatly to overdo the thing, for by reducing too far the food intake and interfering too radically with the fixed habits of the patient we may impair his strength and reduce his circulatory efficiency.

The use of tobacco should be restricted or interdicted. Exercise is necessary, but must be regulated, as excess is followed by a subnormal phase with lowered blood-pressure and rapid pulse. The beneficial or injurious effects of any given amount of exertion may be approximately determined by observing the duration of the subnormal phase and the presence or absence of a secondary rise in pulse-rate. We should so far as we are able take the measure of each patient regarding his reaction to exertion. This may be done by giving him a stated amount of exercise to perform, and then carefully charting out the reaction of blood-pressure and pulse for one hour thereafter. If a pronounced sub-

<sup>(8)</sup> Therap. Gaz., Dec. 15, 1911.

normal phase that endures for much more than onehalf hour results, and especially if a secondary rise in pulse-rate is observed, the physiologic limit for the individual has been exceeded. By repeated observations of the kind the optimum of physical activity may be arrived at.

For those patients who respond poorly to normal activity a good general massage each day will improve the peripheral circulation. One rule which is perhaps wise to enforce with all patients having hypertension is to rest recumbent for a longer period than has been usual with them. They should lie down for half an hour after meals, and the custom of taking an afternoon nap should be put in practice. Regular and early retiring with long hours of sleep should be the rule. distinct advantage is gained if we can enforce occasional periods of rest in bed for hypertension patients. A periodic week in bed on a low diet with daily massage will accomplish more for the inveterate case of high blood-pressure than almost any other measure of treatment. Instead of permitting patients of this kind to "take a holiday" away from medical guidance, subject to irregularities of diet and the danger of physical overstrain, we may far better put them to bed, securing thereby rest to the heart and relief of strain to the arteries. A "bed week" once in every six to twelve weeks according to the stage of the case will prove of the greatest benefit.

A warm bath, lasting about twenty minutes, followed by a brisk rub down, should be taken every morning.

Occasional sweating may be desirable.

The prescription of the diet should be individual and should be regulated according to the following principles: 1. A reduction in the total quantity of food, to conform to the actual needs of the system and to the digestive capacity. 2. A limitation of protein, within 90 gm. of protein as the maximum. It may be necessary to reduce it to 50 or 60 gm. Meat extracts and coffee should be excluded and alcohol allowed only in limited quantities.

An absolute milk diet is apt to have disadvantages,

due to the fact that in order to furnish a sufficient amount of nourishment a large amount of liquid must be introduced and an excessive amount of protein, so that the diet ceases to be well balanced. As much as three quarts of milk are requisite, and this amount will yield about 120 gm. of protein, which is excessive for patients with hypertension. In some cases, however, a milk diet with cereal additions may exercise a very beneficial effect. For cases characterized by temporary toxemia occasional starvation or a limitation of the diet to bread and fruit may be advantageous.

The amount of fluid drunk does not materially alter the blood-pressure so long as the heart is functionating adequately. The extent to which the fluids are to be restricted should depend on the ability of the kidneys to remove water from the system. High tension is not uniformly accompanied by active urine excretion. When the urine is abundant, water may be permitted freely, and when the excretion rises to 2,000 c.c. or higher no restriction of fluids is needed. With a low urine output some parsimony in fluids is indicated, the amount permitted corresponding roughly with the capacity of the kidneys to remove it. When signs of cardiac insufficiency make their appearance fluid restriction should invariably be enforced. The physiologic amount under this latter circumstance may be placed at from 1,000 to 1,200 c.c.

As to salt restriction, certain care is advisable in high pressure cases. In strictly limited amounts salt will do no harm in cases with good cardiac function, and as it adds greatly to the palatability of food it may be permitted within certain limits. In excessive amount salt is a circulatory stimulant, and as it increases tissue lymph and adds to the viscosity of the blood it tends in consequence to raise blood-pressure. It is well in all cases to instruct patients to avoid the use of salt on the food after it is cooked and served. If edema, however slight, is present salt should be excluded entirely from the diet.

Reference should be made to the psychologic treatment of these patients. As a rule they are a highly strung, nervous type of invalid, exceedingly susceptible

to suggestion. They are easily encouraged, very easily depressed. Worry and mental depression exert an unfavorable effect on the blood-pressure. It is a matter of therapeutic importance therefore to keep them hopeful and encouraged. Discouraging opinions and doubts should be withheld. Above all, if it can be possibly avoided, do not tell the patient what his blood-pressure is at the time of your routine observations, otherwise, exaggerating the significance of its fluctuations, he will follow the sphygmomanometer readings with either an elation or discouragement that will in either case do him no good.

The Use of Yohimbin. In a clinical lecture by H. Hochhaus we find a notice of yohimbin in the form of vasotonin as an agent for the reduction of marked increase of blood-pressure. The recommendation of Fellner is to give from once to twice a year twenty to thirty injections of 1 c.c. containing 0.06 of vasotonin with a content of 0.01 of yohimbin. Hochhaus, however, has not had conspicuous success in the few cases which he has treated with this remedy. Other authors appear to

have had better results.

Dietetic Treatment. E. E. Cornwall<sup>1</sup> reports four cases of cardiovascular disease and describes his dietetic treatment. He emphasizes the following points:

1. The most important thing in the treatment of cardiovascular disease is the regulation of the diet.

2. The diet should be regulated so as to supply the maximum of nutrition with the minimum of work for

the crippled cardiovascular system.

3. Such regulation means the restriction of the quantity of food to the minimum health ration or less, and the selection of articles which meet the indications presented by the kidneys, the liver, the heart, the gastrointestinal tract, and the general condition and habits of the patient.

4. The diet in cardiovascular disease should be antiputrefactive, it should be to a large extent purin-free, from it should be excluded the more fermentable carbo-

<sup>(9)</sup> Deutsche med. Wochenschr., Aug. 15, 1912.
(1) N. Y. Med. Jour., June 22, 1912.

hydrates, particularly cane-sugar, it should be easily digestible, and it should be sufficiently laxative.

5. The evening meal should always be a light one, and no food or drink should be taken near the time of sleep-

6. A prophylactic treatment of cardiovascular disease is possible, and consists largely in the regulation, according to the principles above laid down, of the diet of those whose family history or ways of life point to

premature cardiovascular degeneration.

Fraikin and G. de Cardenal<sup>2</sup> believe that dietetic restrictions in arteriosclerosis are often carried too far, leading to a lassitude and weakness that are relieved by a more abundant and rational diet. The restriction to white meat is bad; red meat is better digested and generates fewer toxins than young white meat, such as lamb and veal.

Arterial Gymnastics in Prophylaxis and Treatment. H. French<sup>3</sup> believes that the toxic factor and increased peripheral resistance are insufficient to account for high blood-pressure in most cases of arteriosclerosis. He believes that the absence of the need of variation of the peripheral vessels in men of sedentary life leads to a degeneration of the muscular wall and calcareous infiltration. In these cases a high blood-pressure is necessary to keep up the circulation. This degeneration may be checked if not too far advanced.

Accordingly French believes that arterial gymnastics constitutes a very important point in prophylaxis and treatment. Where the muscle coats of the vessel are beginning to stiffen, but are merely stiff and not fibrous, one can do a very great deal to stave off the progress of the disease by encouraging arterial gymnastics. They are used extensively for this purpose, and have been for years; but perhaps the reason why they do so much good has not been clearly understood.

Massage, periodic purgation, periodic fasting, partial or complete; periodic walking exercise, golf at weekends, boxing, swimming, Turkish baths, various electrical

 <sup>(2)</sup> Jour. de Méd. de Bordeaux, May 19, 1912.
 (3) Lancet, July 13, 1912.

and other treatments, at spas or otherwise, the regulation of water-drinking, dieting, and so forth, all these have as their basis arterial gymnastics either for the peripheral arteries or for those of the viscera. The benefits of graduated Nauheim exercises, with or without the Nauheim baths, may be extraordinarily great even when the patient has a high blood-pressure already. Sometimes the blood-pressure comes down under this treatment, in which case one may suppose that the arteries were still sufficiently lissome to be made once more supple enough for easy control by the vasomotor system. Sometimes the treatment causes the blood-pressure to go up, in which case the main factor is most probably the beneficial action it has upon the output of the heart. When, however, the vessels have become rigid to an extreme degree, one should be exceedingly cautious in the "training" that one puts them through. One should progress very slowly, starting with very simple exercises.

It does not much matter what the exercises are, provided that they serve the purpose of "training" the arteries and the vasomotor nerves again. The less the arteries are called upon daily to adapt themselves to varying requirements, the stiffer and more out of training they become. Two very simple movements for routine use in the prevention of arteriosclerosis that can be performed in the morning after the bath are as follows: The first is that of slow but repeated bending forwards with the arms extended until the fingers touch the toes, returning to the erect posture with the arms bent back as far as possible; repeating this, say, 20 times in succession, hot too fast. The patient who can do this without producing any giddiness at all shows evidence of having an active vasomotor control of his arteries. The other is the imitation of the ordinary dumb-bell exercises whilst the patient at the same time stands upon his toes and hops rhythmically from one foot to the other.

Week-end golf is one of the best antidotes to arteriosclerosis in these days of strenuous indoor city life. A vigorous daily walk serves the same purpose, but walking is going out of fashion.

In conclusion French feels sure the pressure can be

reduced safely only when the muscle of the arterial coats is still muscle, though it may be out of training and stiff. So long as it is muscle it may be rendered lissome again by arterial gymnastics, and so brought back under the control of the vasomotor system, to the great relief of the heart. When, however, the tunica media of most of the arteries, particularly those of the splanchnic area, is fibrous and no longer muscle, a high blood-pressure becomes a necessity if the patient is not to be permanently invalided. If one relies solely upon the "toxic" and the "increased peripheral resistance" theories of arteriosclerosis and high blood-pressure, one may often treat the patient on the wrong lines, the correct lines of treatment being:

1. Prevention, by moderation in eating and drinking, a due alternation of brain work with physical exertion daily; not too long sustained a sameness of arterial caliber, whether in the limbs, the splanchnic area, or the

brain.

2. Relief in the earlier stages, by carefully considered steps that may be classed together under the heading of

arterial gymnastics.

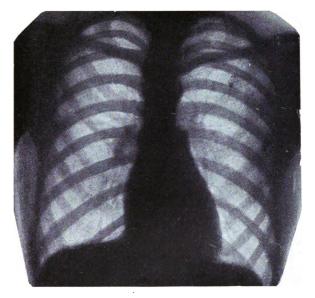
3. Recognition of the fact that when the stiffening stage has passed and fibrosis is already established a high blood-pressure is to a greater or less extent a necessity; that it has to be maintained by the heart; that it could be lessened by lessening the work of the heart, as by invaliding the patient or putting him to bed; but that if the patient is to continue life in anything like its full activity the heart must be enabled to maintain a high blood-pressure, for which purpose iodids, nitrites and so forth are relatively useless; cardiac training by regulated massage, exercises, being far more important, and the chief drugs to rely on when the heart symptoms are well developed being those which increase the force of heart-beat, especially full doses of tineture of digitalis.

General Measures. According to J. M. Swan,\* rest in bed with massage daily is capable of producing a marked reduction in the blood-pressure of a patient suffering from arteriosclerosis. The important details of the diet

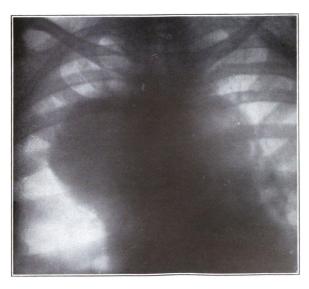
<sup>(4)</sup> Jour. Amer. Med. Assoc., May 11, 1912.

PLATE VI.

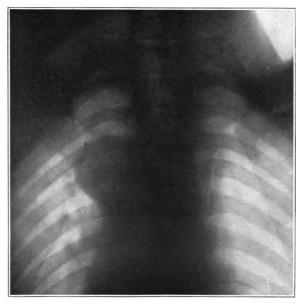
Plates VI, VII and VIII illustrating Hayes' article on diagnosis of aneurism of the thoracic aorta. (Page 284.)



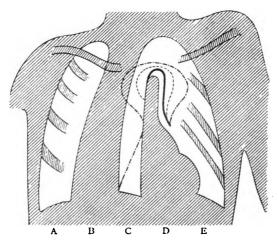
Postero-anterior view of chest.



A large aneurism of the arch. It extends both to the right and to the left of the central opacity. Digitized by Google

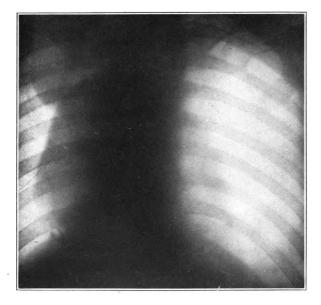


Small aneurism at junction of transverse and descending portions of arch. The chest is viewed from behind.



Right anterior oblique (after Holzknecht).

(From Röntgen Rays in Chest Disease. By Walsham and Orton.)
—— Dilated aorta. . . . . Small commencing aneurism.
—————. Upper part, larger aneurism; lower part, dilated auricle.



Lymphosarcoma.



Aneurism of the arch of the aorta with aneurism of the left common carotid artery.

for patients with arteriosclerosis are, first, to reduce the total amount of food; second, to reduce the amount of protein in the dietary; third, to limit the amount of fluid ingested. Measures that will produce sweatinghot baths with blanket packs, Russian baths, vapor cabinet baths and electric light baths—are capable of reducing the blood-pressure, ameliorating the symptoms in cases of arteriosclerosis with high blood-pressure. thin patients the severer forms of treatment may be replaced by the administration of a neutral full bath of either fresh or salt water. Carbonated brine-Nauheim baths—should not be given in cases of arteriosclerosis with high blood-pressure, particularly when there are indications of nephritis. Faradism, galvanism and the high-frequency current applied to the skin through the vacuum tube are valuable in relieving anesthesias, hyperesthesias and the paresthesias which are met with in cases of arteriosclerosis. Autocondensation may reduce blood-pressure, but the treatment should be given with great care. The crown breeze, particularly administered at bed-time, is capable of relieving insomnia in some cases.

Action of Iodids. Summing up the results from a review of the literature, J. A. Capps concludes that iodids are not active vasodilators, and when long continued do not materially affect blood-pressure. They do not alter the viscosity of the blood to a marked degree. They probably owe their beneficial effects in syphilitic arteriosclerosis to a softening and absorption of the cellular exudate in the arteries. Their efficiency is greatest in the forms of the disease due to syphilis, although it is possible that they act in a similar way on non-

syphilitic exudates.

## AORTITIS.

Etiology. C. L. Cummer and R. Dexter<sup>6</sup> report an analysis of 36 cases of aortic disease with reference to syphilis as an etiologic factor. Of the 36 cases, 73.1 per cent. were males and 85.1 per cent. were between the ages of 35 and 55. The cases had a long period of

Jour. Amer. Med. Assoc., Oct. 12. 1912. Jour. Amer. Med. Assoc., Aug. 10, 1912.

latency. Pain was present as an early symptom in 66

per cent.

Early aortitis gives but meager physical signs. By the time the symptoms have become severe enough to cause the patient to seek medical advice, physical examination will usually reveal the presence of a varying amount of dulness in the second intercostal spaces to the right and left of the sternum. This increased dulness was noted in 17 of their 27 cases. Often this is the only sign, though it may be accompanied by a diastolic impact which is palpable over the upper sternum. Even in the early cases it is usual to hear diastolic murmurs along the left border of the sternum referable to the aortic valve, and when the process has become well established, systolic and diastolic murmurs originating at the aortic orifice are common. Such murmurs were heard in 19 of the cases. The tracheal tug is not usually demonstrable early in the condition, unless there is extensive involvement of the arch of the aorta. sign was noted in 5 of the 27 cases. Visible pulsations, just to the right or to the left of the sternum in the second intercostal space, occur late in the course of the disease. Only 7 cases showed visible pulsations in this region.

From the cases reported by others and the work done on them, together with the material on which this paper is based, the following conclusions seem justifiable:

1. A large proportion (70-75 per cent.) of lesions

of the aorta or aortic valve are syphilitic in origin.

2. Syphilitic aortitis is a definite pathologic and clinical manifestation of syphilis, usually coming late, after the disappearance of the early manifestations, following a long period of latency.

3. Aortitis occasionally is associated with luetic cere-

brospinal manifestations.

4. A complaint of pain in the chest and dyspnea should lead to careful examination of the thorax, especially in the region of the aorta. In case of suggestive or doubtful physical findings, an x-ray examination is desirable.

5. After a diagnosis of aortitis has been made a Was-

sermann reaction should be performed. A positive reaction indicates the desirability of urgent mercurial treatment.

Syphilitic Aortitis; Valvular Disease. A. Morison<sup>7</sup> reports two cases of syphilitic aortitis with valvular incompetency, in one of which necropsy showed typical atheromatous lesions in the aorta with distorted incompetent valves and microscopically a fibrosis of the auriculo-ventricular bundle, although no symptoms of heart-block were observed during life.

The author gives the following description of the clinical and pathologic features of syphilitic aortitis with valvular insufficiency, which he regards as a clinical entity not often recognized before death. When not too far advanced benefit may be expected from specific medication, but when the organic changes are extensive little can be done. Digitalis may be of service in dimin-

ishing an abnormally rapid pulse-rate.

The patient affected with specific aortic valvular disease is usually a man, and generally comparatively young, but not a youth. His age varies from 30 or 35 to about 50. Even on careful investigation, and as a rule, no history of rheumatic or scarlet fever is to be elicited. Nor is there a history of physical disability in earlier The patient has usually followed some active calling, and often that of a soldier or sailor. Ultimately he becomes dyspneic on exertion, frequently complains of attacks of pain in his chest or epigastrium, and on examination reveals aortic valvular disease with consecutive enlargement of the organ.

If he fail to respond to treatment (as he frequently does at the stage at which he presents himself) and die, the necropsy reveals an atheromatous aorta and puckering of the valves, which, considering the comparative youth of the patient in most cases, and an absence of the history of the usual acute infections which induce heart disease, leads, even when syphilitic infection is denied, to a diagnosis of the consequences of that condition. More minute investigation of the textures confirms the correctness of this view.

<sup>(7)</sup> Lancet, Feb. 3, 1912,

### AORTIC ANEURISM.

**X-Ray Diagnosis.** M. J. Hayes describes the x-ray diagnosis of aneurism of the thoracic aorta. The thorax and its contents readily lend themselves to x-ray examination, because the lungs, on account of the air which they contain, are transparent to the rays, and the heart and great thoracic vessels, being opaque, cast dense shadows. More information is to be gained from the screen, or fluoroscope, than from the negative. The latter is useful only as a permanent record of the actual conditions at the time of examination, but it relatively gives very little information, and from it one can get no idea as to whether pulsation exists in the vessels.

In order that any screen examination may be of use it is absolutely necessary that the observer should spend from five to ten minutes in total darkness before making it—this increases the sensibility of the retina—and the room in which he makes the examination should admit

no light.

The normal chest is best examined with the patient in the erect position. With the screen on the front of the chest one sees in the middle line the shadows of the sternum and vertebral column and the great thoracic vessels; at the sides are seen the shadows of the ribs and their interspaces—the ribs produce a lattice-like arrangement. On the left side the heart casts a dense shadow, and its pulsations are distinctly visible. The shadow of the heart gradually merges into that of the left diaphragmatic arch during quiet respiration, but on deep inspiration the two shadows can be differentiated.

The diaphragm on the right and left sides can be clearly seen, the right arch, with the dense liver lying beneath it, being well-defined. It extends about a quarter of an inch higher than the left. During quiet respiration the diaphragm regularly moves upwards and downwards like a piston, the length of the stroke being from one-half to three-quarters of an inch, the average excursion between deep inspiration and full expiration

<sup>(8)</sup> Dublin Jour. Med. Sciences, March, 1912.

being from 2 to  $2\frac{1}{2}$  inches. It is less in the female and in people of short stature with deep chests. Above, the clavicles and the first ribs can be seen.

The mammary glands in the female, especially when they are pendulous or well-developed, cast dense shadows which may be misleading. On moving the gland, of course, its shadow moves also.

With the screen on the back of the chest the same points are clearly seen, except that the outlines of the heart and diaphragmatic arches, which are further away from the chest wall behind, are not so well defined. Neither is the lattice-work arrangement of the ribs seen.

The Right Anterior Oblique View. With the screen on the right side of the front of the chest, and the tube on the left side behind, an oblique view of the thorax can be obtained, and in it we can see in detail the posterior mediastinum. This is the position in which to look for aneurisms of the arch and descending aorta, and no examination of the thoracic vessels is ever complete without viewing the chest in this position.

In the left posterior oblique position, with the screen on the left side of the chest behind, and the tube on the right side of the chest in front, the entire intra-thoracic portion of the descending acrta can be studied. This position is also the best for examination of the thoracic portion of the esophagus for stricture.

In the left lateral position, with the screen on the left side of the chest and the tube on the right side, the antero-posterior diameter of the heart can be determined. In front of the heart is a clear space called the retrosternal triangle. It is formed by the sternum in front, the diaphragm below, and the anterior border of the heart posteriorly. Behind the heart is another clear triangular space called the retrocardiac triangle. It is formed by the vertebral column behind, by the diaphragm below, and by the posterior margin of the heart in front; and here one can plainly see bismuth food pass into the stomach, or an aneurism of the descending aorta if present. In most healthy adults, more especially those living in cities, some enlarged glands around the root of the lung and in the posterior medias-

tinum can be seen. Such are the radioscopic appearances of the normal chest.

That part of the aorta formed by the junction of its transverse and descending portions, called by Walsham and Orton "the left lateral aortic bulge," is not very prominent in young people, and it is always less evident in females than in males. Its size and situation must, however, be carefully noted, as it is a common source of error in the interpretation of negatives. If aneurisms are present they will appear as dark shadows to the right or left of the central dark area. They may or may not be pulsating, and their margins will be defined in proportion to the amount of clot which they contain.

Aneurisms of the aorta can, as a rule, be recognized without much difficulty, but it is not always easy to detect those arising from the innominate, the left common carotid, or the left subclavian arteries, because of the converging upper limits of the thoracic cavity and the smaller amount of transparent lung tissue here situate.

Aneurisms to the right of the vertebral column are, as a rule, on the ascending aorta, those to the left on the descending aorta. A large aneurism of the arch of the aorta (Plate VI) may extend both to the right and to the left of the central opacity formed by the sternum and vertebral column, or it may extend upwards towards the root of the neck. Small aneurisms of the transverse and descending portions of the arch will cast shadows to the left of the vertebral column (Plate VII). The lateral and oblique positions will help to determine the depth at which an aneurism is situate. The aneurism is also nearer to that surface of the chest on which, when viewing it, its limits are most clearly defined.

In aneurisms of the arch this upper end assumes a dumb-bell appearance, having a rounded head and neck. A generally dilated aorta, due to atheroma, may give rise to symptoms simulating aneurism, and its radiographic appearances in an antero-posterior view will very closely simulate one. The diagnosis of this condition can be accurately made only by examining the

chest in the oblique position when the sides of the index finger shadow will be seen to be parallel, and its

upper end will not be bulbous.

From an examination of the chest of a large number of patients, some of whom suffered from angina without any apparent cause for their pain, and others, who were thought to have aneurism, but in whom it did not exist; and many whom he has examined for stricture of the esophagus, Hayes concludes that the general dilatation of the aorta is more common than it is supposed to be. It is the rule to find this condition in most men beyond the age of 50 years who have led strenuous lives, although there may be associated with it no evidence of the existence of atheroma in the peripheral vessels.

Other shadows occurring within the thorax, which may be mistaken for aneurism, may be produced by:—

1. The shadows of new growths are denser than those of aneurisms, their borders are indistinct and ill-defined, and they are not expansile. That they may be effected by transmitted pulsation must be borne in mind.

- 2. A focus of consolidation in the lung, if small and centrally situated, will be entirely surrounded by the transparent lung tissue, and it will be independent of the great vessels. Expansile pulsation must also be sought for, and the outline of the shadow carefully noted. At the root of the neck it is extremely difficult to differentiate between aneurisms arising from the branches of the arch of the aorta and consolidation of the lung apex, and in arriving at a diagnosis the antecedent history of the patient, as well as the symptoms and clinical signs present, must be taken into account.
  - 3. Abscesses or empyema will be recognized by their

situation, their shape, and the history.

4. Enlarged glands produce scattered shadows to either side of the vertebral column, and their appearances are so typical that they are not likely to cause any ambiguity.

Another point to be observed in cases of aneurism is that the long axis of the heart, instead of being oblique, becomes almost horizontal, the base of the heart being depressed and the apex elevated, and this position is independent of any pushing up of the left diaphragm through flatulent distention of the stomach or any such cause.

The position of the heart varies with the position of the patient, but within narrow limits, and the degree of lateral displacement of this organ on rotating the patient from side to side when in the recumbent position is rarely more than one inch in either direction. One case has been recorded in which the entire heart could be displaced for several inches to the right or left by rotating the patient.

Differential Diagnosis of Aortic Aneurism. O. Huber<sup>9</sup> discusses the difficulties in the way of a differential diagnosis by the x-ray between a ortic aneurism and other lesions in the thorax. Scoliosis may cause some doubt, but usually the transillumination in different directions clears up the situation. Tumors of the mediastinum present greater difficulties, because they may be situated on the arch of the aorta. The symptom of pulsation is uncertain and may fail because the movement communicated to the tumor by the aorta is not always distinguishable from a genuine pulsation. On the other hand, pulsation in an aneurism may be entirely lacking especially when the walls of the aneurismal sac are covered with thrombi. If a tumor extends above the aorta as in the case of a sub-sternal goiter the displacement of the clear tracheal band gives a diagnostic sign. Kienböck has called attention lately to a new symptom of diagnostic importance. Circumscribed bulging of the aorta is almost regularly accompanied by a general dilatation of the aorta. If this is lacking aneurism can be excluded with considerable certainty. An aneurism is most plainly seen where the arch of the aorta passes into the descending aorta. In such cases an oblique view shows the space behind the aorta between the spinal column and the shadow of the vessels to be entirely filled up.

The author reports a case in which the picture seemed

<sup>(9)</sup> Berlin. klin. Wochenschr., July 1, 1912.

to indicate an aneurism in this location, but on examination in the oblique direction the space behind the vessels seemed to be quite clear. An examination of the esophagus indicated the presence below the arch of the aorta of a stricture which was probably due to carcinoma. The diagnosis, therefore, was made of carcinoma of the esophagus and the presence of aortic aneurism was regarded as very doubtful. The necropsy showed, however, that in addition to the carcinoma there was, in fact, a thrombus adherent to the wall, and the aorta was drawn so far forward that no filling of the space behind the vessel occurred. Huber calls attention to the necessity of taking the fact into consideration that in consequence of the pull of adherent thrombi in the interior of the aorta a slight displacement of the arch may occur and thus a dilatation of the arch of the aorta may be simulated in the x-ray picture.

Compression by an Aneurism of the Right Brachiocephalic Vein. L. Babonneix and Baron¹ report a
case in which there was swelling of the right side of
the neck and face and the right arm which was referred
to a compression of the right brachiocephalic vein (innominate vein). By auscultation the existence of an
aneurism of the arch of the aorta was diagnosticated
and the swelling was explained as partly due to this
aneurism. By the use of mercurial inunctions the
peripheral swelling disappeared, although the aneurism
remained. The authors conclude that this was due to
a specific inflammation of the mediastinal tissues in connection with an aneurism of the aorta, probably also of
specific origin. They refer to similar cases in which
such a mediastinitis has been demonstrated as the cause

of a similar compression of the vein.

The authors conclude as follows: In cases of obliteration of the superior vena cava or of the brachiocephalic venous trunks one should always take syphilis into consideration and institute a mercurial treatment even when it seems, as in the case reported, that this obliteration is caused by a lesion which cannot be influenced by mercury; for in aneurism of the aorta there

<sup>(1)</sup> Gaz. des Hôp., Jan. 30, 1912.

is almost always a more or less marked amount of specific peri-aneurismal mediastinitis which is the cause of a part of the pathologic phenomena referred to the aneurismal dilatation, and these are in reality due to lesions on which mercurial treatment has often a remarkable effect.

#### THROMBOSIS.

Etiology. From an investigations of the causes of thrombosis. H. Küster<sup>2</sup> finds no reason for believing that an increase in the amount of fibrin is a favorable circumstance for the formation of an embolus or thrombus. At the present time we possess no means of recognizing the premonitory symptoms of thrombosis. It is in the author's opinion no longer permissible to connect the formation of a thrombus with the coagulation of the blood as we have been accustomed for a long time to do.

Thrombosis of the Femoral Artery. Tetsuo Miyata<sup>3</sup> reports a case of thrombosis of the femoral artery with multiple abscesses of the peritoneal cavity following severe catarrh of the large intestine. He draws the following conclusions:

- 1. The patient had first a very severe catarrh of the stomach followed by catarrh of the large intestine. By these diseases the wall of the intestine was very much weakened and the colon bacilli and staphylococci which are found in the intestines easily made their way into the vessels of the diseased intestinal wall. Here they were carried by the blood-stream to the mesentery, the omentum and the peritoneum and the spleen, and produced there diffuse metastatic abscesses.
- 2. In spite of these multiple abscesses there was not a single swelling of the mesenteric glands, which fact affords the best sign that the abscesses were produced by bacteria conveyed by means of the blood-current.
- 3. The bacteria found in the intestinal canal and in the pus-foci were quite similar according to microscopic examination and culture experiments. (They

<sup>(2)</sup> Berlin, klin, Wochenschr., Dec. 18, 1911.
(3) Klin, Therap, Wochenschr., June 17, 1912.

consisted of the Bacillus coli and the Staphylococcus

pyogenes albus.)

4. The author is of the opinion that the thrombosis took its origin from the fact that the patient had become very weak from the successive attacks of diarrhea, and that the activity of his heart was reduced. This occasioned a slowing of the blood-current so that blood-corpuscles probably adhered to the excoriated or ulcerated surfaces of the vessel wall and excited the formation of thrombi.

5. The patient had in spite of the cessation of the diarrheas severe pain in the stomach and inclination to vomit. Tympanites and pain in the abdomen were present to a slight extent, but neither dulness over the abdomen nor any other sign of peritonitis was established. Tenderness in the upper part of the abdomen, especially in the gastric sulcus, was due to abscesses in the mesentery and in other parts of the abdomen. The author has not been able to find another similar case in the literature.

# DISEASES OF THE BLOOD AND BLOOD-MAKING ORGANS

### THE BLOOD.

Value of Examinations. E. H. Shaw<sup>4</sup> reports a number of cases illustrating the value of blood examinations, e. g., revealing polynuclear leukocytosis indicative of abscess, or great increase in the number of lymphocytes assuring the diagnosis of lymphatic leukemia, with corresponding prognosis, and others differentiating various types of anemia. The value of bacteriologic examinations is also shown.

Emanation Content. W. Engelmann<sup>5</sup> reports observations to show that the drinking of water containing radium emanations is sufficient to cause the blood to take up the emanations, so that in this way a continued presence of emanation in the blood can be secured. If it is possible by inhalation therapy to increase the emanation content of the blood to very high values during the course of the inhalation, we possess in the treatment by drinking the possibility of maintaining the emanation content in the blood and in the organism for several hours. By repeated drinking it might be possible without any great difficulty to secure the action of the emanation during the whole day, which would constitute under some circumstances a very important advantage of the drinking method over that of inhalation.

Viscosity. J. Matsuo<sup>6</sup> has investigated the viscosity of the blood in the Japanese and finds, as would be naturally expected, that in consequence of their vegetable diet, it is on the average smaller than that of the

<sup>(4)</sup> Lancet, Aug. 3, 1912. (5) Berlin. klin. Wochenschr., May 27, 1912. (6) Deutsches Archiv f. klin. Med., May, 1912.

European. In healthy Japanese the viscoscity averages in males 4,428, in females, 4,017. This corresponds with the amount of hemoglobin, which is for males 100.16, for females 90.19; and with the number of red blood-cells, which is for men 5,024,520, and in women 4,729,100. In both healthy people and anemics there is found a certain parallelism between the viscosity and the amount of hemoglobin as well as the number of red blood-cells. This is especially regular among healthy individuals, particularly in the relation between the hemoglobin and the viscosity. The quotient hemogl. visc. is, according to the author's investigations, on the average 22.75 for healthy persons, 13.58 for the anemic.

In most anemic individuals the intensity of the venous hum is inversely proportional to the amount of viscosity of the blood. The venous hum can almost always be heard if the viscosity sinks below 2.8, and in the same anemic individual in whom this murmur has previously been plainly heard it disappears if the value of the viscosity rises to 3.0. In the author's opinion this fact supports the explanation given by Sahli for the

origin of the venous hum in anemias.

Specific Gravity. A. Ross' describes the method for determining the specific gravity of the blood, particularly that of Hammerschlag, which consists in determining what mixture of benzol and chloroform will just float a drop of blood, and then finding the specific gravity of the mixture. A similar method is to make a number of mixtures of glycerin and water, of different specific gravities, and find the one which will just float the drop of the blood to be tested. The best method of using the solution clinically is outlined in Rogers' book. A series of small glass-stoppered testing bottles is put up, labelled, and boxed in numerical order. A drop of blood is drawn up in a capillary pipette, fitted with a rubber cap, and gently expelled into the bottles in turn till one is found in which it just floats suspended, or, breaking up slowly, rises and falls at the same time: this bottle gives the required specific gravity. If it is found, for example, that the drop rises slowly in 1052 and sinks

<sup>(7)</sup> Lancet, Dec. 2, 1911.

slowly in 1050 the specific gravity is intermediate—viz., 1051. The best way to obtain the blood in children is by placing a ligature round the big toe. It makes no difference to the reading whether the blood is obtained from the thumb in this way or from the lobe of the ear without pressure.

Rogers believes this determination to be of great value in cases of cholera. Ross doubts if it will prove as important a guide to the treatment of epidemic enteritis by the Rogers method as it appears to be in the case of cholera. His opinion is that outside of this disease, determinations of the specific gravity of the

blood are of very minor importance.

Action of X-Rays on Eosinophiles. C. Aubertin and M. L. Giroux<sup>8</sup> have investigated the action of the x-ray on the eosinophiles, and conclude that the irradiation of the hematopoietic centers in a person with many eosinophiles produces immediately a leukocytosis which continues for some hours. This leukocytosis is not, as in normal subjects, a pure polynuclear leukocytosis, but it is constituted especially by an increase of the pre-existing eosinophiles, to which are added a certain number of neutrophiles; consequently, while in healthy persons and in patients with myeloid leukemia the leukocytosis excited by the x-ray is a neutrophile polynucleosis, it is not due to a special action of the x-rays on the neutrophiles: it results rather from the fact that the neutrophiles in such persons are the predominant cells in the blood and in the hematopoietic organs. In other words, such persons react to the x-ray by a leukocytosis affecting particularly the granular leukocytes that predominate in their blood and in the deposits in their hematopoietic organs. In the normal condition these are naturally the neutrophiles; in patients with myeloid leukemia they are also the neutrophiles, for these cells are still in the great majority in their blood, although much modified; and in the patient under observation, whose eosinophiles reached 65 per 100, the leukocytosis was especially an eosinophile leukocytosis.

The x-rays, therefore, did not act on the blood as in



<sup>(8)</sup> Presse Méd., July 13, 1912.

infections, which provoke an exclusively neutrophile reaction. They acted equally upon the eosinophiles. In moderate doses they cause these cells to emigrate into the blood. In large doses they destroy them as in the

case of patients under treatment for leukemia.

Blood-Platelets. S. T. Darling concludes an investigation of the relations of blood-platelets in tropical and other forms of anemia as follows: Blood-platelets, according to Wright, are the detached portions of the cytoplasm of certain large marrow cells, called by Howell megalokaryocytes. They are diminished in number in certain diseases, such as malaria, hemoglobinuric fever, uncinariasis, verruga Peruviana, a relapsing fever, kala-azar, and typhoid fever at certain phases of the disease; and they are also diminished in number in Addisonian anemia, lymphatic leukemia and purpura hemorrhagica.

The platelets are increased in number in myelogenous leukemia and in myeloid neoplasms, such as Hodgkin's disease. This suggests that the giant-cells described by Reed and others in Hodgkin's disease are megalokary-ocytes, and that Hodgkin's disease is a myelomatosis of certain lymphoid elements; as a diagnostic corollary, the clinical separation of true Hodgkin's disease from lymphosarcoma follows when the latter does not con-

tain megalokaryocytes.

The size and staining characters of the platelets are sometimes altered, this being analogous to such changes in the erythrocytes as microcytosis, poikilocytosis, macrocytosis and polychromasia. It is believed that if the changes in numbers and morphology to which the platelets are subject in various diseases are observed more carefully, they will furnish material help in the diagnosis of diseases affecting the blood-forming organs.

Fever Due to Destruction of Blood-Platelets. H. Freund gives the results of his investigation of fever occasioned by the destruction of the blood-platelets, which produced a pyrogenic substance. It is quite pos-

 <sup>(9)</sup> Trans. Soc. Trop. Med. and Hygiene, November, 1911,
 (1) Deutsches Archiv f. klin. Med., May, 1912.

sible that the destruction of the blood-platelets in the body itself is due to the great sensitiveness of these bodies to toxic or infectious causes. This would be a probable general explanation for the origin of fever. That fever by the destruction of the blood-platelets occupies a peculiar position among the fevers that are not of bacterial origin is shown by the following experiment.

In animals which had starved for five to six days the fever-producing action of the blood-platelets was not reduced but rather increased, while the aseptic fevers which have been so far investigated do not occur in the starving condition. Inasmuch as this is one of the principal differences between aseptic fevers and those of bacterial origin the fever produced by destruction of the blood-platelets is entirely comparable to the infectious fevers.

Leukocytes During Sleep. G. Fulpius<sup>2</sup> has investigated the changes in the number of leukocytes in the s ne subject while awake and just on awaking from as 'eep. He finds that there is no essential difference in the amount of blood, the number of red cells, or the amount of hemoglobin, nor in the total number of leukocytes, but he finds a marked change in the relative number of leukocytes. The polynuclears are reduced from a percentage of 65—70 to 35. On the other hand the lymphocytes rise from a percentage of 25, to one of 60 to 70. This experience explains the different records that have been made of the proportion of leukocytes in some diseases. Thus in tuberculosis if the observation is made early in the morning the lymphocytes will preponderate, but if the blood is taken later in the day the condition will approach the state of normal persons with a preponderance of polynuclear neutrophiles.

Antitoxic Power of Leukocytes. Investigations by M. Massonis lead to the conclusion that the leukocytes are capable of hindering to a large extent the effects of anaphylaxis, and hence, as the results of the action of bacteria are largely due to toxic action of an anaphylactic nature, the author believes that we must ascribe

<sup>(2)</sup> Sem. Méd., June 28, 1911.
(3) Berlin. klin. Wochenschr., Dec. 25, 1911.

to the leukocytes a considerable power to destroy poisons as well as to act on the bacteria themselves.

Daily Variations of Leukocytes. By a new device for counting the leukocytes, which gives very accurate results, D. Thomson<sup>4</sup> has determined the number of leukocytes in several diseases, particularly malaria, Hodgkin's disease and cancer. In malaria he found an intermittent leukocytosis corresponding almost with the changes in the malaria, a leukopenia occurring at the time of the greatest prevalence of the plasmodia, while with the decrease of the parasites the number of leukocytes increased. The leukocytes increased at the time of the fall of temperature. Thomson attributes this to the sporulation of small numbers of parasites. He found that the injection of five to ten millions of dead parasites led to a pronounced leukocytosis.

In Hodgkin's disease the leukocytic increase also takes place with the fall of the fever, and the mononuclears tend to increase with the increase of the leukocytosis, and constitute about 80 per cent. of all the leukocytes. This high percentage of leukocytes is a deviation from what is usually found in Hodgkin's disease, and indicates a transition to the type of lymphatic leukemia.

A case of cancer was also investigated. The leukocyte chart of this case shows a variation very similar to that of the Hodgkin's disease. There is a marked daily rise and fall in the number of leukocytes. The variation on the average amounts to from 5,000 to 40,000 leukocytes per cubic millimeter of blood, an eight-fold increase. The leukocytes reach their height about midday, and are lowest about midnight.

The total mononuclear percentage, however, unlike that of Hodgkin's disease, remains at about the normal level, and there seems to be a tendency for the mononuclear percentage to fall with the leukocyte rise.

Basophile Granules and Polychromasia. H. Wickern and F. Piotrowski<sup>5</sup> have investigated the frequency with which erythrocytes with basophile and polychro-

<sup>(4)</sup> Brit. Med. Jour., Dec. 16, 1911.
(5) Deutsches Archiv f. klip. Med., May, 1912.

matophile granules occur in various forms of anemia. They conclude as the principal results of their investigations that the basophile granules and the polychromatic blood-corpuscles are to be regarded as the products of regenerative activity. Every form of loss of blood appears to favor the appearance of such cells, but the absorption of blood in such cases acts as a stimulus to the further production. An essential condition for the appearance of blood-cells with basophile granules and of polychromasia is evidently the ability of the system to regenerate the blood, and it is probable that the erythrocytes are washed out of the bone-marrow in the following order: first the polychromatic, then those with basophile granules, and finally the nucleated erythrocytes.

## HODGKIN'S DISEASE.

Etiology. E. Rosenfeld reports a case of a patient who was suddenly attacked with chills and symptoms of a lung affection. In addition there was found a firm, enlarged gland in the neck, of the size of a hazelnut, and a hard tumor of the spleen of moderate size. Gradually the swelling of the spleen and the liver became more prominent as well as a tumor which was felt beneath the sternum and was referred to a swollen lymph-gland, and the fever in its further course assumed a pronounced recurrent type. An increase and decrease in the swelling of the spleen and liver appeared, parallel with the fever. The blood showed a leukopenia and later a moderate anemia. Death occurred after seven months as a result of cardiac weakness. In the necropsy a tissue was found in the glands, spleen and liver, which was regarded as granulation tissue, and bacteriologic investigation showed the presence of the bacilli and granules of Much. These are considered by their discoverer as modified tubercle bacilli. Rosenfeld regards the findings in his case as favoring the idea of the tubercle bacillus as a cause of the cases known as pseudoleukemia.

F. Blumburg<sup>8</sup> reports four cases, with necropsy in

<sup>(7)</sup> Berlin, klin. Wochenschr., Dec. 4, 1911.
(8) Mittell. a. d. Grenzgeb, d. Med. u. Chir., XIV, 3.

three. In two of these cases there was no indication of ordinary tuberculosis, but the granules of Much were found indicating a connection with tuberculous affections.

S. Laache reports the results of examinations of ten patients with pseudoleukemia and sums up his results as follows: There were ten cases of clinically diagnosticated lymphatic pseudoleukemia, in six of which a necropsy was performed. In one case there was an extensive cheesy degeneration of the lymph-glands, i. e., an undoubted tuberculous pseudoleukemia. In two cases, and in addition in a third case in which there was no necropsy, according to the investigation of an extirpated gland, granuloma was demonstrated. case was a round-celled sarcoma. Lymphatic pseudoleukemia includes two principal groups, granuloma and sarcoma. According to the clinical picture (for the most part high fever, frequently accompanied with hectic symptoms and abundant sweat, tachycardia and the diazo-reaction in the urine), there are many points of contact between granulomatosis (Sternberg) and tuberculosis.

Genuine sarcoma ought in the future, if a certain diagnosis has been made, to be excluded from the group of lymphatic pseudoleukemias.

K. Kaufmann¹ reports three cases, in two of which there was a complicating or causal tuberculosis.

Treatment by X-Ray. A. Stengel and H. K. Pancoast<sup>2</sup> make the following remarks on the treatment of Hodgkin's disease with the x-ray: In Hodgkin's disease the radiation must be directed to the localized enlargements. The more experience one has with the treatment of this disease the more he is inclined to regard it, from the therapeutic standpoint at least, as closely analogous to lymphosarcoma. The majority of cases certainly resemble the latter closely in the manner in which they react.

From the x-ray therapeutic point of view we might

<sup>(9)</sup> Deutsches Archiv f. klin. Med.
(1) Beiträge z. Klin. der Tuberkulose, B. 23, H. 1.
(2) Jour. Amer. Med. Assoc., Sept. 28, 1912.



recognize three distinct groups of cases. To one group belongs a small percentage in which the enlargements are localized to one region, respond rather promptly to treatment, and either do not recur, or if they do, usually because of insufficient radiation, the recurrence is limited to the same area, without metastasis, and readily responds again.

The second group includes the majority of cases. In them the enlargements may be more or less localized, or general; they respond to treatment slowly, and not only recur invariably, but also give rise to metastases in nearby or even distant structures. These patients ultimately die as a rule, but we can do much toward prolonging life, sometimes for years, by keeping up a constant fight and attacking the metastases as they appear. In such cases with general enlargements, we can practically never expect a complete disappearance of those within the chest, abdomen or pelvis. With such patients we must pursue a more or less palliative course, and keep up the treatment indefinitely.

To the third group belong a small percentage of cases which do not seem to respond to radiation, and some of which may be rendered so toxic as to necessitate its

discontinuance.

A large percentage of cases of Hodgkin's disease will exhibit toxic phenomena a few hours after each of the earlier applications, and this is just as apt to occur in a case with a small localized group of glands of moderate size as in one with extremely large glands or widespread enlargements. The patient may complain only of a headache, but may have a slight chill and moderate rise of temperature. These phenomena follow only the first few treatments as a rule, but they are manifest so frequently that the authors as a rule begin the treatment of all cases with diminished dosage, increasing it to a maximum gradually.

## LEUKEMIA.

Myeloid Leukemia with Chylous Ascites. H. S. Furness and G. F. Stebbing's report the case of a man, aged

<sup>(3)</sup> Lancet, Sept. 23, 1911.

40, who entered the hospital with myeloid leukemia complicated with chylous ascites. The patient died twelve days after admission. The condition of the blood was as follows: Hemoglobin, 65 per cent.; red cells, 4,500,000; and white cells, 326,000. A differential count of the white cells gave the following percentages: Polymorphonuclear neutrophiles, 41.6; myelocytes, 52.4; eosinophile myelocytes, 0.4; small lymphocytes, 2.8; large lymphocytes, 1.6; eosinophile leukocytes, 0.4; and mast-cells, 0.8. A specimen of the ascitic fluid was examined by the Clinical Research Association, who reported as follows:—

A faintly alkaline opalescent fluid of specific gravity 1015, only moderately albuminous in character. The opalescence persists after prolonged centrifugalizing, but is more or less cleared up by extraction with ether, and the ethereal extract is found to yield a moderate quantity of fat. The centrifugalized deposit from the fluid consists of leukocytes with a slight admixture of red blood-corpuscles. The following are the percentages of a differential count: Myelocytes, 28; eosinophile myelocytes, 12; polymorphonuclear neutrophiles, 23; lymphocytes, 7; eosinophile leukocytes, 8; and mast-cells, 22.

The urine of the patient was milky in appearance like the ascitic fluid, and also contained myelocytes and

a large quantity of albumin.

On post-mortem examination free fluid was found in the chest and the abdomen; that in the abdomen had the appearance already described, and that in the chest presented the ordinary characters of a serous pleural effusion. There was marked perisplenitis, the capsule of the spleen being greatly thickened and adherent to the anterior abdominal wall and omentum. Sections of the liver, the spleen, and the kidneys showed very numerous leukemic nodules, which had the usual appearance under the microscope. A section from a gland in the neighborhood of the discharging sinus in the neck showed characteristic tuberculous giant-cells and patches of degeneration.

The interest of the case lies in the presence of large

numbers of myelocytes in the ascitic fluid and urine, the chylous nature of the ascites, and the extensive general enlargement of the lymphatic glands.

Lymphatic Leukemia. E. Holzer reports a rare case of lymphatic leukemia with the following points of

interest:

1. Gland hyperplasia confined to mediastinal and mesenteric glands.

2. Comparatively low white count.

3. High percentage of lymphocytes and correspondingly low percentage of polymorphonuclears. (No case was found in the literature in which the polymorphonuclear percentage was as low as 2.2 per cent.)

4. The case was apparently purely lymphatic, no evidence of the myelogenous type, either enlarged spleen

or myelocytes, being found.

5. Absence of all symptoms except local until a

short time preceding death.

**Treatment.** A. Stengel and H. K. Pancoast<sup>5</sup> still recommend the treatment of the bones by x-ray in leukemia, because:

1. In general, the expectation of life is greater.

2. Patients as a rule regain health and strength more rapidly, owing in part, no doubt, to the avoidance of early toxemia; and the average patient is soon able to resume his or her occupation, even though the leukocyte count remains high.

3. This method is certainly attended by fewer dan-

gers from toxemia and x-ray dermatitis.

In order to derive the greatest possible benefit from the treatment, it must be administered carefully and intelligently. The general technic that has been previously described in detail is still followed. Experience has proved that it has certain features which require special emphasis:

1. The application should be made systematically to the bones of the entire body, with the exception of the head, the body being mapped out into definite areas for

the purpose.

 <sup>(4)</sup> Jour. Amer. Med. Assoc., May 25, 1912.
 (5) Jour. Amer. Med. Assoc., Sept. 28, 1912.

2. Exactness in dosage is always most important. It should be so regulated as to produce the necessary

effect without inducing toxemia, if possible.

3. The frequency of the applications is equally important. They should be made daily when possible, and prolonged periods of rest should not be permitted. Life has been shortened months or even years in many instances through disobedience of this injunction, or failure to insist on it.

4. Direct exposure of the spleen and other secondary enlargements should be carefully avoided during the earlier part of the treatment; this applies especially to the very large spleens of the myelogenous form of the disease. The first important reason for this is the avoidance of the undesirable toxemia that is likely to follow, especially in advanced toxic cases; and the second is the fact that the more rapid decrease in the leukocytosis that is likely to follow is apt to be misleading because it is not entirely due to the effect of the radiation on the primary seat of the disease.

5. The duration of the treatment has an important bearing upon the prolongation of life. Applications should not be discontinued or lessened in frequency until normal conditions prevail, if this be possible. By "normal conditions" is meant the disappearance of every manifestation of the disease, including abnor-

malities in the differential count.

6. The leukocyte count may be an important clinical factor in showing the patient's condition, and is perhaps the most direct single index we have as to the effect of the treatment on the disease, but it is by no means so dependable in the latter application as it is generally regarded. In fact, it should not be relied on to any extent as a direct index, except at practically one stage of the treatment. If we are able to reach the point where the leukocyte-count has subsided to normal or nearly normal figures, the differential count becomes more and more important as the guide for continuing or stopping the applications.

7. Arsenic is frequently a valuable adjunct to radiation, as already explained, but it is too often misused.

If radiation is to be regarded as the essential therapeutic agent, and there are no special indications for giving arsenic, it should be used with careful reservation, as it is likely to interfere seriously with the proper and adequate administration of the x-ray treatment. It should never be given in large doses during radiation. If for any reason the patient is obliged to discontinue the x-ray for any considerable period of time, arsenic should, of course, take its place.

8. Particular attention should be paid to the care of the skin from the very beginning, as the ultimate result or the duration of life, at least, may be largely

dependent on the tolerance of the integument.

9. Radiation is contra-indicated in practically all cases of acute leukemia, as it will only hasten death. The same may be said of many chronic cases during acute stages with associated severe toxemias, although considerable benefit may be derived from the treatment of some of these cases. When we do undertake to treat them, the greatest care is required in handling them. The dosage should be much reduced at the start, and the applications should be limited to the extremities until there are some definite signs of improvement. the condition appears to become distinctly aggravated by the treatment, this should be discontinued; but if there seems to be any improvement, or even if the case appears to be made a trifle worse, radiation should be continued, and the dosage gradually increased with care, but kept within safe limits.

10. Of all the patients who have responded in any way favorably to the treatment, those of lymphatic type give somewhat better ultimate results than those of

myelogenous type.

Treatment by Thorium-X. Nagelschmidt<sup>7</sup> reports a case of leukemia treated by thorium-x with some remarkable results. In the first day, about sixteen hours after the first injection, the patient noticed that the abdomen became very soft and that the spleen, which had been very large and firm, suddenly became soft, so that it felt as if one put his hand into a thick mush.

<sup>(7)</sup> Deutsche med. Wochenschr., Sept. 26, 1912.

This remarkable appearance disappeared after about half an hour and no reduction in the size of the spleen could be discovered. After the injection the patient looked cachectic, lost his appetite completely and was very weak. The author administered iron for this condition with a remarkable improvement in the general The second injection produced no recognizable disturbance of the general condition even under an observation of five weeks. The splenic tumor became somewhat reduced. The author regards the evidences of cachexia as due to an action of thorium-x and were the expression for the most part of a severe chlorosis, occasioned by an enormous loss of iron.

Treatment by Benzol. A. von Koryanyi, eled by the reports of three cases of benzol-poisoning accompanied by purpura hemorrhagica and by the physiologic studies of Selling, who showed that benzol reduces the number of white blood-corpuscles after a primary increase, concluded to investigate the effect of this remedy in leukemia. He reaches the following conclusions:

Benzol after a temporary increase in the number of white blood-cells leads to an essential improvement in the leukemic blood-picture. The reduction in number of the white cells begins as a rule at the end of the second or the beginning of the third week, progressing slowly at first and then rapidly. After an unimportant decrease, the number of the red blood-corpuscles remains practically constant for a long time. After long treatment an increase of the erythrocytes has been observed. Success seems to result from the treatment in all forms of chronic leukemia. In an advanced stage of the treatment the swelling of the spleen is markedly reduced. The lymph-glands are apparently less influ-The general condition improves in a similar manner as after a successful x-ray treatment.

Benzol as a rule leads to a successful result more slowly than x-ray treatment, although success can be achieved with benzol even though the Röntgen treatment has failed. Patients who have been previously

<sup>(8)</sup> Berlin, klin, Wochenschr., July 15, 1912,

treated with the x-ray appear to respond to benzol more quickly than those who have never been treated in this way. The result of the benzol therapy appears to be a

temporary one.

Small doses of benzol stimulate the formation of leukocytes. For this reason as large doses as possible are indicated in leukemia. From 3 to 5 gm. of benzol daily are tolerated as a rule. In some cases the author ordered for a short time 5 gm. without any bad results. Unpleasant side effects may occur, such as a burning in the stomach, belching, occasional tracheo-bronchitis and dizziness. As a rule there are no complaints referable to the stomach if oil is given in equal amounts with the benzol in gelatin capsules. If dizziness occurs a

trial should be made with smaller single doses.

4. As, in general, pathologically increased function is more easily moderated than such as is confined in its intensity to physiologic limits, the author tried the benzol in a case of polycythemia with splenic tumor and a normal number of white cells. The result was encouraging. At the end of the first week after the beginning of the treatment the number of erythrocytes rose from nine to ten million and then decreased within three weeks to 6,700,000. As the patient considered himself cured, he was lost to further observation. Further experience will be necessary to determine to what extent benzol therapy may be applied in leukemias and possibly in polycythemia, and what place it may assume beside the x-ray therapy, which often acts in a more brilliant manner, or beside thorium therapy.

Benzol is best used in capsules filled at the time of taking. From 30 to 60 minims per day may be used. Cream or olive oil taken at the same time relieves burning and eructations of benzol. In most patients there is a coincident rise in the leukocyte count with the taking of the remedy. Within a week or ten days a rapid fall in the number of leukocytes occurs, and a diminution in the size of the spleen. The hemoglobin increases in amount

and the red cells in number. 1—B.]

<sup>(1)</sup> Jour. Amer. Med. Assoc., Feb. 15, 1913.

## PERNICIOUS ANEMIA.

Etiology. Relation to Leukemia. V. Ellermann<sup>9</sup> thinks that there are numerous reasons for assuming that myeloid leukemia, lymphatic leukemia and essential pernicious anemia are all allied affections, just as the three forms of malaria, tertian, quartan, etc., are allied. As the infectious nature of leukemia has been demonstrated by animal experimentation, it seems plausible to assume the same origin for pernicious anemia with its three groups of anatomic changes, the gastritis, the production of marrow tissue in the long bones and the myeloid transformation of the spleen and liver and the secondary anemic changes, fatty degeneration and siderosis. If pernicious anemia is of infectious origin. this would explain the benefit from arsenic. An invisible virus has been discovered as responsible for fowl leukemia and a filterable virus for epidemic anemia in horses and in a similar disease in dogs, not to mention kala-azar in man, the parasites for which are well known.

Tuberculous Pernicious Anemia. P. Courmont and A. Dufourt¹ report a case of pernicious anemia due to tuberculosis, and discuss the subject of pernicious anemia on a tuberculous basis, reaching the following conclusions:

While little is known concerning the pathogenesis of pernicious anemias in tuberculosis it is evident that this disease must play a large part in the hemolytic processes and the tuberculous anemias may be characterized as follows: The bacillus of Koch and its toxins act directly on the blood and the hematopoietic organs, or they may act only indirectly by causing organic lesions. In the first case the bacillus makes its action felt either by producing specific lesions of the hematopoietic organs (lymphademia, for instance) or by diffusing hemolytic products which act in loco or which pass into the circulating blood. (Hemolysins, local or free.) In the second case the bacillus does not produce these lesions directly, but changes the organs (the liver, digestive tract,

 <sup>(9)</sup> Deutsche med. Wochenschr., May 2, 1912.
 (1) Gaz. des Hôp., Feb. 8, 1912.

kidney) which in their turn produce toxins and hemolytic products (gastro-intestinal, or hepatic hemolysins). The first pathogenesis may be supported by two sorts of arguments, experiments made in vitro with the bacillus of Koch which prove its hemolytic action, and experiments showing that certain bacilli produce a destruction of the red blood-corpuscles in vivo. These two points, although on a solid basis, need to be controlled. The second pathogenesis would have the merit of reconciling the anatomico-pathologic facts of lesions of various organs capable, when diseased of themselves, of producing substances which induce anemia.

Cercomonas Infection. G. Franchini<sup>8</sup> reports a case of severe parasitic anemia. The patient had recurring attacks of severe anemia, weakness, abdominal pain and diarrhea during twelve years, with intervals of years of comparative health. Finally a severe attack was traced to the presence of the Cercomonas in the intestines; the reds numbered only 500,000 and the hemoglobin was only 17 per cent when treatment was instituted. The patient rapidly recuperated as the parasites were expelled. another case a woman had had symptoms of gastric ulcer for years; it finally perforated, and in the pus aspirated from the circumscribed peritonitis the Cercomonas was found in great numbers. These protozoa had not been responsible probably for the lesion in this case, but their presence had evidently aided in keeping up the chronic irritation. Guastalla has reported a similar case, the gastro-intestinal symptoms having been observed at intervals for twenty years before the parasite was finally discovered in the stools. In the above cases no benefit was obtained from any measures until after the parasites had been expelled. Franchini gives a colored plate of the parasites grown on agar, showing up well the flagella and spine in certain phases of their growth.

Pathology. C. D. Camp' reports a case of pernicious anemia causing spinal cord changes and a mental condition resembling paresis. The examination pointed to lesions in both the posterior and lateral columns of the

 <sup>(3)</sup> Policlinico, March, 1912.
 (4) Med. Record, Jan. 27, 1912.

### PLATE IX.

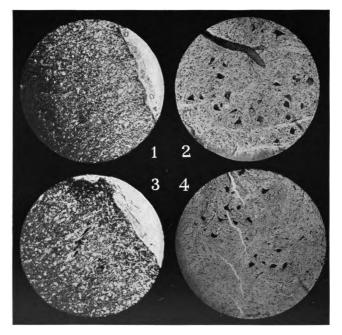


Fig. 1.—Author's case of pernicious anemia. Cross-section of lumbar cord showing marked evidence of disease of the posterior columns. Fig. 2.—Cross-section of lumbar cord showing involvement of the anterior horns.

Fig. 3.—Cross-section of upper thoracic cord showing degenerative changes in the white matter.

Fig. 4.—Cross-section of upper thoracic cord showing degenerated cells in anterior horns.—Willson. (Page 310.)

spinal cord; the former shown by the ataxia. Rombergism, sensory changes, and lost Achilles reflexes, and the latter by the spasticity and the positive Babinski reflex. The positive Babinski reflex and the spasticity would preclude the diagnosis of uncomplicated tabes, as would also the absence of any change in the pupillary reflexes, and the absence of any characteristic crises, lightning pains, and bladder disturbance. If a tabo-paralysis were thought of we should still have to account for the absence of the Argyll-Robertson pupil and the negative Wassermann reaction. The negative findings in the cerebrospinal fluid are almost conclusively against the diagnosis of paresis or any syphilitic or parasyphilitic disease of the brain or spinal cord. There was no history obtainable of any toxic factor, such as lead or alcohol, as a cause of the spinal cord changes.

It would seem that the mental symptoms shown by these patients were very similar in each case. Attacks of anger usher in the cases, but are accompanied by some feelings of regret after they have passed. Delusions of being poisoned are frequent, but the delusions are entirely unsystematized. Mental exaltation is present, with grandiose ideas, especially with respect to the patient's own condition. There is no disorientation for time or place, no memory defect, no hallucination or fabrication such as seen in Korsakoff's syndrome. The mental state most closely resembles paresis, though there hardly seems to be as much intellectual disturbance as is usual in any case of dementia, and the anger and suspicions are rather foreign to the usual paretic type of case.

In the case reported and in those quoted there were no pupillary signs, optic atrophy, or convulsive seizures. According to Van Wart, these phenomena may also be caused by pernicious anemia, so that there may be cases in which these symptoms might be combined with the above-described mental state and so lead to even greater difficulties in diagnosis. It seems to be of scientific interest as well as the greatest practical importance to know that pernicious anemia can be the cause of a syndrome of nervous and mental symptoms that so closely resembles paresis that a clinical differentiation between them cannot

be made with certainty without the examination of the

blood and cerebrospinal fluid.

The Spinal Cord Lesions. R. N. Willson<sup>5</sup> calls attention to the fact that there exist spinal cord and perhaps even brain changes in every case of true progressive anemia, and that many cases that fail of prompt recognition owing to nervous symptoms would at once become clear if this fact were kept in mind.

The spinal cord lesions consist of a combined sclerosis of the posterior and lateral columns. Occasionally the posterior columns are alone affected and there is presented a definite picture of tabes dorsalis. The lateral columns never constitute the only field of involvement. Usually the degeneration appears to start in the upper dorsal or lower cervical cord, the posterior columns sustaining the earliest and most severe attack. In the author's case the lumbar cord showed the most marked evidences of disease. The lateral columns in most cases are also sooner or later involved, and the anterior horns show both clinical and microscopic signs of disease. The pathologic process consists of a degenerative vacuolization of the nerve cells, accompanied, or rather, succeeded by a replacement gliosis.

A considerable number of cases have been reported in which the anterior horns were involved to such an extent that the clinical amyotrophic result was confused with emaciation and obscured the diagnosis. This is an occurrence of the late stages of the intoxication, however, and in view of our present information it would seem as though this confusion should no longer be necessary, even though the blood-picture may not yet have assumed the definite character of pernicious anemia and of pseudocombined sclerosis. (See Plate IX, Figs. 1-4.)

Willson reports a case showing these changes and presenting some interesting features in the family and personal history. Several of the patient's relatives had suffered from nervous and visceral disease which justified the supposition of hereditary luetic influence running throughout this long series of circulatory and nervous involvements. There have been a number of recent at-

<sup>(5)</sup> Jour. Am. Med. Assoc., Sept. 7, 1912.

tempts to demonstrate the syphilitic origin of pernicious anemia.

[A history such as that of Willson's case indicates the strong possibility of an intestinal origin, not only of pernicious anemia, but of the pseudocombined spinal sclerosis. The patient had had a series of colds which the author is inclined to attribute to a toxemia metabolic in origin, having its source in the gastro-intestinal canal. It seems evident that this toxemia led up to, if it did not cause the pernicious anemia, the spinal cord sclerosis, and the fatal termination of the case. The author advances the view that syphilis lay at the basis of this gastro-intestinal affection.—S.]

**Symptomatology.** Early Symptoms. O. Schaumann<sup>6</sup> concludes, after prolonged study, that pernicious anemia may occur with a nearly normal hemoglobin percentage. In a typical case suspicion was first aroused by a periodically recurring feeling of soreness in the tongue and mouth, sometimes also in the throat. The tongue was at

first deeply grooved, but moist and not coated.

Anemic Vomiting. A. P. Beddard reports four cases of anemic vomiting occurring in women. He says such patients are liable to severe attacks of epigastric pain and vomiting, which may be mistaken for gastric perforation and frequently for gastric ulcer. The symptoms of anemic vomiting are pain in the epigastrium and vomiting. Almost everything placed in the stomach gives rise to the pain, which is relieved by the vomiting. The symptoms point to hyperesthesia of the mucous membrane of the stomach, which in turn is due to dilatation of the heart. An active stretching of the cardiac muscle is a common process in anemic girls, especially when they have to do comparatively hard work. This process is frequently associated with severe pain and tenderness referred to two parts of the body; (a) The skin and muscles under the left breast. Many of these patients complain of this pain; in others the tenderness is demonstrated only by firm palpation. There is, of course, nothing the matter with these structures, although they

<sup>(6)</sup> Deutsche med. Wochenschr., June 27, 1912. (7) Practitioner, March, 1912.



may be so tender that the patient cannot bear her clothes to touch them. (b) The mucous membrane of the stomach. This may become so hyperesthetic that whatever touches it causes pain and the stomach empties itself. If pain is thus referred from a stretching heart to the stomach, it follows that anything which suddenly increases the stretching process will increase the pain in the stomach and lead to vomiting. Therefore, in anemic vomiting, exertion, like running upstairs, is liable to bring on just the same pain and vomiting as food does; if the exertion is long and arduous, the attacks of pain and vomiting may be so severe as roughly to simulate perforation of the stomach.

Beddard says that these very severe attacks, which may induce the unwary to open the patient's abdomen, are in many respects comparable to the gastric crises of locomotor ataxia. In both conditions pain is referred to the mucous membrane of a stomach which may in itself be perfectly healthy, and yet the hyperesthesia of the stomach may be so great as to lead to severe and prolonged attacks of vomiting; of course, the ultimate cause of the pain in the two conditions is different. The treatment comprises absolute rest in bed, diet, 2 drops of Fowler's solution three times a day. To this may be added at once, or in the course of a few days, 10 grains of citrate of iron and ammonia.

In Pregnancy. T. Pontanos reports a case of pregnancy complicated by extreme anemia in which the hemoglobin dropped to 25 per cent. and the reds to 870,000 with 7,000 whites, at the eighth month, but the blood-picture returned to normal after the birth of the child soon after. In the second pregnancy the same pernicious condition recurred, hemoglobin 20 per cent., reds 735,000, whites 14,000, of which 5 per cent. were normoblasts and megaloblasts. After spontaneous abortion the blood-picture rapidly improved anew. This patient had had malaria but was apparently free from it at this time. In a recent cose of Botaffio's a woman who had had this pernicious anemia during one pregnancy had no return of it in a second pregnancy. Notwithstanding this, Pon-

<sup>(8)</sup> Policlinico, March 3, 1912.

tano thinks it is wise to interrupt the pregnancy when the blood shows such serious changes early. However,

he adds, no general rule can be formulated.

Treatment. J. Hürter reports the results of the treatment of thirty-five cases of pernicious anemia. Although no effectual treatment is known, he says, yet a number of empirical measures have proved useful and, strictly applied, occasionally recoveries have been observed under them. Chief among them is bed rest, but the patients often rebel against this, as they feel well. He advises keeping the patients in bed until the blood shows a marked change for the better. Repose in the open air may advantageously alternate with bed rest. Light massage may be useful. Thorough examination for possible intestinal parasites is the first measure, and it is necessary to investigate the stomach functioning to remedy the individual deficiencies. In regard to diet, stimulation of the appetite is of predominant importance: fruit juices and lemonade should be freely allowed. With simple gastric achylia, lavage of the fasting stomach in the morning with physiologic salt solution often proves The food should be extremely nourishing and digestible, and nutrient enemas sometimes are valuable to supplement the ordinary food. Hürter is inclined to regard transfusion of blood as a valuable adjuvant; he does not wait too long, but makes the transfusion as soon as the blood-picture ceases to show evidences of regenera-He injects 200 or 250 c.c. of blood and states that symptoms of anaphylaxis have never been observed. Unless sure of one's technic and assistance, the blood had better be defibrinated, but the natural blood should be preferred. He follows the Moritz method of transfusion, using a 100 c.c. syringe. He adds that in two of his thirty-five cases dyspnea followed the transfusion. In one case it suggested pulmonary embolism at first, but it rapidly subsided. In the second case the patient died two days later and peculiar foci were found in the lungs; they were not typical of embolism but suggested intravascular coagulation. No by-effects were ever noted with defibrinated blood. He has observed transient improve-

<sup>(9)</sup> Med. Klinik, Dec. 31, 1912,

ment in the blood-picture under administration of bonemarrow, and as we need all the leverage power possible to aid in starting the regeneration of the blood, he advises using this organotherapy. He gives generally 30 or 40 gm. of the fresh bone-marrow from calves, generally in tablets made with 90 parts marrow, 30 parts port wine, 30 parts glycerin and 20 parts gelatin, mixing the marrow with the wine in one hot mortar, and the glycerin and gelatin in another, and then combining. Barr says that such tablets will keep for months. Hürter concludes with a reference to glycerin, stating that he has a vague impression that some benefit was apparent from glycerin given in large doses during the day—30 gm. in lemon juice, 20 gm. in capsules and 30 gm. by the rectum.

Thorium-X. A. Bickel¹ reports a case of pernicious anemia which had been treated by several methods, particularly by the injection of arsenic, without result. The patient was in an extremely wretched condition. He had extensive edema, was very dyspneic, and so weak that he could not walk more than a few paces without assistance. He received daily 50,000 mache units of thorium-x in 3 portions, which he drank after the principal meal. The improvement was very marked, not only in the subjective symptoms, but also in the objective symptoms such as the edema, and enlargement of the liver and spleen. At the end of five weeks the patient was so well that he insisted on going on a journey.

Salvarsan. B. Bramwell<sup>2</sup> reports seven cases of pernicious anemia in which salvarsan was used with results which he regards as very favorable. It appears to be superior to other forms of arsenic. In one case no immediate benefit was produced but the patient, given up to die, after ten days of coma, revived and made at least a temporary recovery. The drug in this case was given

intramuscularly.

## SPLENIC ANEMIA.

Symptoms. H. L. Hull<sup>3</sup> reports a case of splenic anemia presenting the following unusual features.

<sup>(1)</sup> Berlin. klin. Wochenschr., July 8, 1912. (2) Brit. Med. Jour., June 22, 1912. (3) Jour. Amer. Med. Assoc., Dec. 9, 1911.

The absence of hemorrhages from the mucous membranes (epistaxis, hematemesis, etc.), which are so common in the reported cases.

The presence on several occasions of an excess of 2. eosinophiles, of myelocytes and nucleated red cells.

The irregular and elevated course of the tempera-

ture over a period of at least three months.

Treatment. G. Urbino urges the importance of early splenectomy in cases of splenic anemia or Banti's disease. Five of his nine cases were cured by the removal of the spleen, which must be regarded as a source of toxemia in this affection. The affection continued an insidious, but progressive course until local discomfort led to the discovery of the enlarged spleen and a correct diagnosis. From one to four years had elapsed before the spleen was removed and none of those in an advanced stage were cured; so that the author wards against grave lesions of the liver, hemorrhage and ascites, as contraindicating splenectomy. After the splenectomy there is liable to be severe gastro-intestinal hemorrhage which should be combated with hot irrigation of the intestine, vasoconstrictor drugs and saline infusions. He warns further that there is lessened resistance to infection for a few days after splenectomy.

## ERYTHROCYTHEMIA.

W. Hale White reports three cases of erythrocythemia, in one of which the amount of blood was estimated, and found to be three times the amount of normal blood, while the number of corpuscles reached double the normal number, the heart being obliged to propel six times the normal number of corpuscles, which must have greatly increased the labor of maintaining the circulation.

Annie L. Hamilton and Mary E. Morse<sup>2</sup> report a case of erythrocythemia, in which the patient perished from gastrorrhagia, losing over six quarts of blood.

A. Sunde<sup>8</sup> gives the particulars of a case of polycy-

<sup>(4)</sup> Archiv. internat. de Chirurg., V. 8. (1) Lancet, Jan. 6, 1912. (2) Boston Med. and Surg. Jour., June 27, 1912. (3) Norsk Mag. f. Laegevidenskaben, September, 1912.

themia with enlargement of the spleen, in a man of 55; also a case of polycythemia with very high blood-pressure, and two other cases in which the polycythemia was secondary to cancer or heart disease. He also tabulates the details of fifteen cases of heart or kidney disease in which the number of red cells was unusually high. In two of these secondary cases the number of red cells dropped when the diuresis increased, and climbed up when the diuresis declined. In some of the cases the red cells dropped permanently to the normal figure when asytolia was corrected.

In the treatment of the essential form with enlargement of the spleen, the diet should be mainly milk and vegetables, and otherwise regulated to ward off the tendency to apoplexy. No benefit from Röntgenotherapy was observed in the cases reported. An insignificant reduction in the number of red cells followed four repetitions of venesection, withdrawing 300 gm. of blood and once 750 gm., combined with saline infusion. Nature seems to resort to spontaneous hemorrhages as a safety The patients must be warned against over-exertion and abuse of tobacco and alcohol. Iodin preparations seem to reduce the viscosity of the blood. In the case without enlargement of the spleen but with exceptionally high blood-pressure, the highest number of red cells coincided with the highest blood-pressure. The bone-marrow in the femur showed marked hyperplasia and was deep red.

## PURPURA.

Classification. According to D. Elliott and H. S. Maitland, purpura is conveniently divided into primary and secondary. The primary forms include the following:

1. Purpura simplex, characterized by isolated blood spots, usually in the form of very small petechiæ in the skin, as the only clinical symptom. The eruption is rarely accompanied by gastric disturbances, loss of appetite, depression, vomiting, though there may be slight fever.

<sup>(1)</sup> N. Y. Med. Jour., Nov. 18, 1911,

2. Purpura hemorrhagica, characterized by a more severe type of hemorrhage with involvement of mucous membranes. This may be accompanied by slight or severe constitutional disturbances.

3. Purpura rheumatica, "Schönlein's disease," characterized by a combination of purpura hemorrhagica with arthritic symptoms and severe constitutional disturb-

ances.

4. Henoch's purpura; a form of arthritic purpura encountered usually in children, which is associated with severe gastro-intestinal symptoms, vomiting, diarrhea, and sometimes collapse. This form may be also seen without joint symptoms.

5. Purpura fulminans; first described by Litten in 1881, but named by Henoch, in 1887, who saw three cases.

The following classification of the symptomatic forms

is due to Osler:

A. Infectious purpuras, as in small-pox, measles, scarlet fever, typhus, and ulcerative endocarditis.

B. Toxic purpuras, such as are produced by quinine, copaiba, iodid of potassium, snake venom (particularly rattlesnake type), and icteric purpura.

C. Cachetic purpuras, as in carcinoma, tuberculosis,

nephritis, senility, pernicious anemia, and leukemia.

D. Nervous conditions, rare in tabes and hysteria.

E. Mechanical purpuras, as slight bruises, straining

efforts in whooping-cough, etc.

Elliott and Maitland call attention to the probable fact that even the so-called primary forms sometimes depend on some other condition, and believe that this may always be the case, although the true cause is not always discovered. They report a case in which a fulminating purpura developed in the course of pneumonia, leading to death with gangrene of the limbs on the sixth day of the disease.

Purpura Hemorrhagica. J. M. Wallfield<sup>1</sup> reports a case of purpura hemorrhagica, which developed from an apparent purpura simplex. M. Litten remarks: "We never know, however, whether the disease will continue in this form or develop into the more severe form

<sup>(1)</sup> N. Y. Med. Jour., Feb. 10, 1912.

of purpura hemorrhagica." Wallfield gives the points of interest in his case as follows:

- 1. The gradual development from one form to another.
- 2. The pain was always localized on the right side of the abdomen, simulating an appendicular attack.

3. The history of rheumatism in both parents.

4. Two severe relapses on slight changes in diet during improvement. Hecker of Munich came to the conclusion that one case of Henoch's disease was due to errors in diet and alcoholism. His patient was a boy, ten years old, a son of a restaurant-keeper.

5. The uncertainty of the prognosis, though it looked a mild case at the start. Hecker warns us to be cautious on account of the grave condition and impending

nephritis.

6. The swelling in the popliteal space. Pratt says that no case of bleeding into the joints in purpura has been found in recent literature.

Pathogenesis. W. W. Duke<sup>1</sup> presents an interesting study of the pathogenesis of this disease, especially with reference to the part played by the blood-platelets. By comparing symptoms and blood-findings in all patients observed during a period of three years, who displayed a pathologic tendency to bleed, Duke succeeded in picking out a certain group of cases which present a characteristic clinical picture, which is due wholly or in part, it is believed, to an enormous reduction in the number of blood-platelets. The disease in its severer form almost constantly presents the following symptomcomplex: 1. Purpura of one or two types, petechias or ecchymoses. 2. Hemorrhage from mucous membranes. 3. A tendency to bleed from every vascular lesion, no matter how produced. In consequence of this tendency, the bleeding-time is very greatly prolonged, often exceeding two hours. 4. A normal coagulation time. 5. A firm blood-clot. 6. In consequence of the absence of platelets, a clot which does not retract and extrude serum. In all cases (seven) seen by Duke showing the above picture, the number of platelets was reduced al-

<sup>(1)</sup> Archiv. Int. Med., Nov. 15, 1912,

most to a point of absence. Counts were all below 10,000, and as a rule below 1,000. (The normal platelet-count varies from 200,000 to 400,000.)

The disease in its milder form presents a different picture. The most common symptoms in the milder cases are ecchymoses following slight injury and epistaxis. Sometimes neither purpura nor bleeding from normal mucous membranes appears, and the only evidence of hemorrhagic diathesis in severe hemorrhage is accounted for to a greater or less extent by local causes; for example, continued bleeding from intestinal ulcers, from esophageal varices, profuse and prolonged menstruation, etc. The bleeding-time in the mild cases is sometimes normal and sometimes slightly or moderately prolonged. The coagulation time is normal, the clot firm, retractility diminished. The diagnosis rests on the finding of a reduced platelet-count. It varied, in Duke's cases (six), from 20,000 to 65,000.

Hemorrhagic diathesis can be followed best in this disease by determining the bleeding-time at frequent intervals. The simple observation of purpura, spontaneous hemorrhage, etc., may lead to false conclusions in regard to the general condition, for these symptoms are often due to general and local causes combined. When there was opportunity to make such observations it was noted that the disease appeared when the platelet-count fell to an extremely low level, persisted so long as the count remained low, and disappeared as soon as the The disease was relieved immediately in count rose. two cases by direct transfusion of blood. The relief was coincident with an increase in the platelet-count, evidently a direct result of the transfusion. The symptoms returned when the platelet-count fell again.

The disease was produced in rabbits by reducing the platelet-count with diphtheria toxin. This disease appeared the day the platelet-count descended to a point of almost complete absence and persisted until the platelet-count rose. Hemorrhagic diathesis in mild form was brought about with repeated injections of benzol. In the latter experiments the count did not descend to such a low level as in the former. In a series of thirty-eight

animal experiments, in which the platelet-count was enormously changed with subcutaneous injections of benzol. diphtheria toxin and tuberculin, and also in a large series of cases in human beings in which routine platelet-counts were made, only those having extremely low counts gave the complete symptom-complex described above. Several platelet-counts between 40,000 and 75. 000 were observed in patients who had no marked tendency to bleed. This seems to be the level at which patients may or may not have an abnormal tendency to bleed. No counts lower than these were observed in patients not subject to hemorrhage. The disease has been observed complicating a varied set of diseases in severe form in lymphocytic leukemia, hemorrhagic small-pox, tuberculosis, nephritis, benzol poisoning, aplastic anemia, and diphtheria. The one feature in common in these days was the low platelet-count and the modification of the clot dependent on it; i. e., absence of retractility. Purpura hemorrhagica of the type described would seem, therefore, a symptom, not a disease. It is caused apparently by any agent which reduces the platelet-count to a sufficient degree.

# DISEASES OF THE DUCTLESS GLANDS

### THYROID GLAND.

Etiology of Simple Goiter. A spore-bearing bacillus was isolated by R. McCarrison<sup>2</sup> in pure cultures, from the feces of a goitrous horse and was constantly present in the cultures from the feces of goitrous individuals. It is a rod-shaped bacillus, varying from 2 to 4 microns in size, which does not retain the stain by Gram's method, but stains well with carbol-fuchsin, Leishman's and other stains. The bacilli vary in size and thickness and some of them contain a lighter unstained area, situated usually at the center, but sometimes towards the periphery of the organism. The growth on Musgrave's agar shows, in addition to the bacilli, numerous round unstained bodies, which are seen to be spores when special staining methods are employed. In some of the bacilli spore-formation is also seen. The organism is very actively motile in young cultures. Plate cultures on agar and Musgrave's medium appear as small, round and opaque white colonies. The deeper colonies are irregular, with crenated margins, and are bluish-white in color. The growth is more profuse on alkaline agar than on Musgrave's medium. On agar slopes a profuse opaque growth, white lead in color when viewed from the surface, and faintly brown in color with transmitted light, is seen after twenty-four hours. The organism ferments glucose, levulose, mannose and galactose, but not dextrose, mannite, lactose or maltose. It produces no curdling or acid in litmus milk and grows profusely in broth, forming a white scum on the surface. It does not liquefy gelatin in stab cultures; in this medium it forms a button-like growth into the medium, with both

<sup>(2)</sup> Annals Trop. Med. and Parasitology, December, 1911.

superficial and deep gas production. On potato there is a profuse brownish growth.

Heart Disturbances in Connection with Endemic Goiter. J. Bauer<sup>3</sup> concludes as follows from a study of cases of endemic goiter:

- 1. There is frequently found a pathologic and clinical condition of the heart which cannot be included under any of the previously known forms of goitrous heart.
- 2. This condition of the heart is frequently characterized by an accidental systolic murmur, especially over the pulmonary artery, by an accentuated second pulmonary tone and a slight enlargement of the heart dulness to the left. The apex beat is not increased, the pulse is not accelerated, and there are no striking subjective heart symptoms.

3. This condition of the heart is most probably to be regarded as thyreotoxic and may be classified as the torpid form of thyreotoxic goitrous heart, along with the

excitable form of Krauss.

4. There are many transition forms between the normal and the torpid or excitable heart.

## HYPOTHYROIDISM.

Congenital Mysedema. E. Thomas calls attention to the possibility of a diminished activity of the thyroid due to congenital conditions which are insufficient to cause total failure. Especially he refers to cases in which the first appearance of myxedematous symptoms was in the second year of life and the duration of the life of the affected children was considerably prolonged. These effects he attributes to the presence of tissue of a thyroid character at the base of the tongue. In such cases the thyroid gland is not reduced in all its diameters in its typical position. He concludes as follows:

1. There is not only a congenital total lack of the

thyroid gland, but also a hypoplasia.

2. In these cases we find not a uniformly shrunken organ in the typical position but the thyroid tissue is

<sup>(3)</sup> Deutsche med. Wochenschr., Oct. 17, 1912. (4) Deutsche med. Wochenschr., March 7, 1912.

displaced, mostly included in tumors at the base of the tongue.

3. Cases of total aplasia of the thyroid gland do not survive the age of puberty. In cases of congenital myxedema which have grown to adult life we have to do most probably with a congenital (dystrophic) hypoplasia.

Use of Thyroid Extracts. A. Siegmund<sup>5</sup> discusses at some length the principles which govern the use of the extracts of the ductless glands, particularly thyroidin. While this remedy is an extremely satisfactory one, both to physician and patient, it is, however, not an ideal medicine. The first objection is that it is not a single substance, but a mixture, and secondly, it is derived from animal and not from human tissues, as a rule from slaughtered animals generally in a very fat condition, with not very vigorous thyroid glands. By the process of drying, much of the strength of the fresh thyroid gland is lost, and it is probable that when we cannot apply this remedy in the nascent condition as it were, it falls far below the power of the naturally produced thyroid secretion. Finally, it is probable that the digestive secretions produce further undesirable Thyroidin contains many of the materials which are produced by the thyroid but probably not all.

Since the conditions for which this remedy is applied are due to the presence or lack of some one of a number of substances which may be contained in the thyroidin, the application of this remedy may in some cases neutralize the action of one of the substances producing the symptoms of the disease, while it aggravates the action of others by the increased amount of such substances which it contains. Such an excess of some of the constituents may be quite injurious. This is shown by Basedow's disease, which is in large part the result of an excess of the secretion of the thyroid gland. Such results are, to be sure, rare.

A similar principle governs the application of the antithyroid serum of Moebius. This serum does not contain any of the many substances produced by the thyroid which are normally contained in the blood. It

<sup>(5)</sup> Wien. med. Wochenschr., Nov. 24, 1912.

is supposed to contain all of the substances which neutralize the secretions of the thyroid gland, and therefore, in cases of a great excess of all the secretions of the thyroid it will produce excellent results by neutralizing all of these excessive products. But in cases of incomplete Basedow's disease in which some of the ingredients of the secretion are produced in greater amounts than others, the effect may be that the toxic action of those substances which are not neutralized will prove disadvantageous.

In spite of these deficiencies the application of thyroidin in case of a deficient action of the thyroid gland, gives most satisfactory results. In addition the author believes that it may be of especial value as an antidote to the injurious action of excessive secretion of other ductless glands. These organs act not only in groups having a similar tendency but also in groups opposed to each other. Thus the sympathetic nerve is influenced in an opposite way by two groups of ductless glands. The observation of Latzko has shown that ovarian substance has a favorable influence on Basedow's disease. In a similar way it may be expected that the thyroid secretion will act as an antidote to an over-activity of the ovary.

The amount of thyroidin to be given to small children is very small, as their thyroids normally at first contain no iodin and later only a small quantity. One grain (0.05 gm.) per day is sufficient at first in mild cases in nurslings. Children aged six often take without harm 0.2 to 0.4 gm. (3 to 6 gr.). One should make careful The diet should contain little or trials in such cases. no meat, for meat contains apparently substances poisonous for the thyroid. In treating every case of thyroid insufficiency the question should be considered whether the patient does not require, together with the thyroid extract, the material of other ductless glands. Such a mixed treatment is of value if the insufficiency of other glands is the cause or accompaniment or result of the thyroid insufficiency.

An alternation of these remedies is often desirable. Search should be made for other causes of thyroid insufficiency, such as malaria, syphilis, improper diet, etc. The condition of the nose should be carefully examined. In fact, in treating deficiency of the thyroid a careful investigation of the entire organism should be made.

The author calls attention to the need of investigation as to the individual substances which enter into the ctiology of different cases of thyroid insufficiency. The discovery of these individual substances will make possible a genuine antitoxic therapy of the same.

### EXOPHTHALMIC GOITER.

F. Dyrenfurth<sup>6</sup> reports three Trauma. cases of exophthalmic goiter developing after an acci-In two cases a predisposition was evident, with stigmata of hysteria. In the third case, however, a man in apparently perfect health was involved in an automobile and street-car accident, and two or three weeks after the physical pain had subsided nervous symptoms developed, and six months later symptoms of exophthalmic goiter. Operative measures do not seem to give very favorable results.

Experimental Exophthalmic Goiter. M. Baruch<sup>7</sup> has been able to induce a syndrome in many instances closely resembling exophthalmic goiter in man, by injecting the ground human goiter material into the peritoneal cavity in dogs, rabbits and rats. In none of the cases was the goiter material obtained from persons with goiter of the

exophthalmic type.

Congenital Exophthalmic Goiter. C. White records a case in which a woman, aged 23 years, suffering from exophthalmic goiter, gave birth to a child presenting all the features of the disease present in the mother. The eyes were prominent and staring, and the thyroid gland showed well-marked uniform enlargement. The heartbeats were uncountable, and only a loud murmur was heard over the precordium. There was also a fine tremor of the hand. The child died after an extra-uterine life of thirty-five hours.

Pathologic Anatomy. At the close of an exhaustive study of the pathologic anatomy of exophthalmic goiter

Deutsche med. Wochenschr., Nov. 21, 1912. Zentralbl. f. Chir., March 9, 1912. Jour. Obst. and Gyn. of the Brit. Empire, April, 1912.

D. Marine and C. H. Lenhart<sup>9</sup> give the following summary and conclusions:

The anatomic changes in the several body tissues in exophthalmic goiter are variable and manifold. The most prominent and most constant change is active hyperplasia of the thyroid and lymphoid tissues. These changes are not constant, since the exophthalmic goiter syndrome, as at present recognized, may coexist with a normal thyroid, with a colloid goiter, with an actively hyperplastic thyroid, with an atrophic thyroid, or with a tumor of the thyroid.

The great majority of individuals presenting this syndrome in recognizable form have some degree of active thyroid and lymphoid hyperplasia, and the authors believe that all true cases with complete clinical syndromes have had, during their developmental stage, active thyroid and lymphoid hyperplasia. Active thyroid and lymphoid hyperplasia are not specific for this syndrome, since similar anatomic changes are present in a variety of other abnormal body states.

The series of anatomic changes which occur in a thyroid as it passes from its normal or its colloid state through active hyperplasia and on to atrophy or to colloid goiter, represents the biologic reaction of this tissue whenever those biochemic disturbances in the nutrition of the organism occur, which excite its compensatory activity.

Active thyroid hyperplasia means thyroid insufficiency, and although the causes which excite this activity are unknown and, therefore, may or may not be multiple, still the basic anatomic reaction of the thyroid tissue seems to be the same in all the several clinical varieties of goiter, and indeed seems to be the only one with which the thyroid tissue is endowed.

The only defined physiologic activity of the thyroid secretion is that determined by its iodin content. Iodin is related to the exophthalmic-goiter thyroid in the same way that iodin is related to the thyroid of other clinical associations and of other animals as well, viz., that iodin varies inversely with the degree of active hyperplasia.

<sup>(9)</sup> Arch. Int. Med., Sept. 15, 1911.

The ability of the exophthalmic goiter thyroid to take up iodin varies with the degree of active hyperplasia (hence inversely with the amount of iodin present) and is similar to that of other active thyroid hyperplasias in man and the lower animals. Iodin induces the same series of anatomic changes in exophthalmic-thyroid goiter as in the other varieties of thyroid hyperplasias in man and animals.

The temperature and pulse reactions both before and after operation tend to vary with the degree of thyroid and lymphoid hyperplasia. The differences between the reactions in cases with normal or with colloid glands and the reactions in cases with marked hyperplasias are too slight for a suggestion of any cause and effect relation. The pulse and temperature reactions and the thyroid hyperplasia are parallel and resultant phenomena, dependent on more general and more remote causes.

An incomplete exophthalmic-goiter syndrome may exist with the normal thyroid, or the thyroid may be markedly hyperplastic with the syndrome absent, or, finally, the histologic structure and iodin-content of the thyroid in a given case of exophthalmic goiter may be reversed without necessarily modifying the symptom-complex.

Myxedema does not precede it, occasionally accompanies it, but usually supervenes late in the course of exophthalmic goiter, and is to be looked on as the end

stage of thyroid insufficiency.

The immediate post-operative mortality with its associated high temperature and pulse-rate in uncomplicated cases, varies with the degree of active lymphoid and thyroid hyperplasias, and is most probably the result of profound general weakness and exhaustion of the organism. The degree of active lymphoid and thyroid hyperplasia is therefore the best index of the severity of the disease.

The essential physiologic disturbance of the thyroid in exophthalmic goiter is insufficiency, its reaction compen-

satory, and its significance symptomatic.

D. Marine<sup>1</sup> also reviews the anatomic and physiologic changes produced in the thyroid in exophthalmic goiter, and concludes as follows:

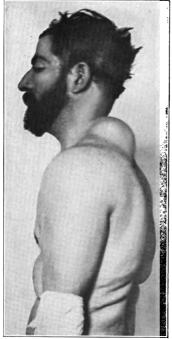
<sup>(1)</sup> Jour. Amer. Med. Assoc., Aug. 3, 1912.

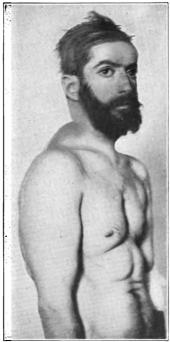
- 1. Neither specific nor constant anatomic changes in the thyroid of exophthalmic goiter have as yet been demonstrated.
- 2. The iodin-content, the storage of iodin in the gland, and the involution of active hyperplasia by the use of iodin are, so far as is at present known, identical with those iodin relations common to other clinical associations.
- 3. The thyroid of exophthalmic goiter has no different pharmacologic action on animals or therapeutic action on myxedema, or toxic action on patients with exophthalmic goiter than thyroid preparations of other clinical associations with like iodin-contents.

Symptomatology. Stomach Symptoms. J. M. Wolpe<sup>2</sup> has investigated the gastric secretion in 23 cases of exophthalmic goiter, with the following results: In the majority of cases there was gastric achylia, most pronounced in the most typical cases. There was a parallelism between the hydrochloric acid secretion and the strength of the gastric juice in pepsin and fat-splitting ferments. The free and combined hydrochloric acid and total acidity were all markedly decreased, and the chymification of the stomach contents was seriously impaired. In old, untreated cases there was a true atrophy of the gastric glands. The digestive disturbances and diarrhea seemed to be of gastric origin but it was impossible to determine how far they were influenced by disturbances of pancreatic secretion, stimulation of the abdominal sympathetic, intoxication by the excessive thyroid secretion, etc. The stomach symptoms are the result of a constitutional asthenia caused by the thyroid poison. The diarrhea improved on a nitrogen-free diet and grew worse on a meat diet.

Pancreatic Symptoms. A. Bittorf<sup>8</sup> reports a case in which over 50 per cent. of the fat passed unutilized through the alimentary tract, indicating functional disturbance in the pancreas in connection with severe exophthalmic goiter accompanied by defective function of the heart and kidneys.

<sup>(2)</sup> Deutsches Archiv f. klin. Med., B. 107, Nos. 5-6.
(3) Deutsche med. Wochenschr., May 30, 1912.





Symmetrical lipomatosis in exophthalmic goiter.—Neuwelt. (Page 329.)

Symmetrical Lipomatosis. L. Neuwelt\* reports a case of exophthalmic goiter with symmetrical lipomatosis. The size of the tumors varied from one the size of a pea, to the largest, which was between the scapulæ, about four inches in diameter. The operation for the removal of the tumor was followed by delirium tremens ending in death. The tumors were all situated symmetrically on both sides of the body with the exception of the one removed which was in the midline. There were no tumors below the level of the umbilicus. (See Plate X.)

Associated Symptoms. H. Curschmann<sup>5</sup> calls attention to some cases in his practice in which the severe and complete picture of exophthalmic goiter developed at intervals, accompanied by other paroxysmal phenomena indicating disturbances in both the cerebrospinal and sympathetic nerve systems. He has found only one reference in the literature (H. Herz, 1902) to Basedow symptoms occurring intermittently in connection with vasomotor ataxia. His first patient had tabes, and during his severe gastric crises all the symptoms of exophthalmic goiter developed in a pronounced form, the exophthalmos, tachvcardia, sweating and tremor, and the thyroid swelled. At first all these symptoms subsided with the gastric crises without leaving a trace, but in time there was permanent persistence of slight exophthalmos and thyroid enlargement all the time, becoming exaggerated during the crises. In his two other cases the intermittent Basedow accompanied attacks of asthma. The exophthalmos, tachycardia, sweating and tremor were associated with various vasomotor symptoms, redness of the face and conjunctiva, cyanosis of the fingers, etc., and psychic disturbances, irritability, agitation, depression, etc., but the thyroid did not become enlarged. One of the men had symmetrical lipomas in his neck, and these swelled notably during the attacks but subsided again afterward, confirming the assumption of a connection between lipomas and thyroid functioning. The same injurious influence which induced the asthma and the

<sup>(4)</sup> Jour. Amer. Med. Assoc., Jan. 20, 1912. (5) Zeitschr. f. klin. Med., B. 76, Nos. 3-4. Abs, in Jour. Amer. Med. Assoc., Nov. 23, 1912,

thyroid intoxication, manifested in the intermittent Basedow, acted on the vasomotors of the lipomas. The essential primal cause seems to be thus some irritation of the nerves regulating the secretion of the thyroid.

Curschmann's three cases of intermittent exophthalmic goiter throw light on the mechanism of the affection, and are further interesting from the therapeutic action displayed by epinephrin in regard to the tabetic crises. He found that three to ten drops of the 1:1,000 solution, by the mouth, arrested the crises much sooner and more effectually than morphin and sodium nitrate. The epinephrin proved effectual also in arresting the asthma

plus Basedow attacks in the other cases.

Acute Exophthalmic Goiter. H. Schlesinger<sup>6</sup> calls attention to the deceptive clinical picture sometimes presented by acute Basedow's disease, simulating cancer, lymph-node tuberculosis or typhoid. In his experience, the patients came to the hospital with the diagnosis of hidden cancer. The leading symptoms of exophthalmic goiter may be missing and the more uncommon symptoms predominant. The most striking symptom is the rapid loss of weight. This is more rapidly extreme than even with cancer. One such patient lost forty-four pounds in a month, another sixty-six pounds in ten weeks, and in a recent case the patient's weight dropped from 189 to 61 pounds—a loss of two-thirds of her weight in eleven weeks. Acute exophthalmic goiter should be suspected in every case of rapid loss of weight. Another frequent symptom is enlargement of the spleen. Fever is more common with the acute than with chronic Basedow. the acute cases the thyroid may be normal in appearance or even smaller than usual, but auscultation reveals the vascular murmurs of true Basedow, soft, continuous, with rhythmic systolic accentuation or an arterial sibilant sound during the systole. This rare type of systolic vascular murmur he has encountered only in elderly patients with Basedow. A persistent retraction of the upper lid. Stellwag's sign, was observed very often and early, and tachycardia was constant. The pulse is that char-

<sup>(6)</sup> Therap, der Gegenwart, November, 1912. Abs. in Jour. Amer. Med. Assoc., Dec. 7, 1912.

acteristic of Basedow but the arteries are generally relatively small, with thin walls. The blood changes are the same as those noted in chronic exophthalmic goiter, as also the irregular diarrhea without cause or after emotions. There may be an excessive appetite or none. In three cases considerable jaundice with emaciation were the only symptoms at first of what proved to be acute exophthalmic goiter. Glycosuria is often observed also; the emaciation is sometimes ascribed to this alone. Alimentary glycosuria could always be elicited in his cases, and the reaction was positive in the one case in which the alimentary galactosuria test was applied. A correct diagnosis is particularly important, as persons with acute exophthalmic goiter are exceptionally susceptible to external injurious influences; an insignificant operation, a brief general anesthesia or mild infection may prove fatal. Many such cases have been published, and it is safe to assume that numbers of others have not been reported. One of his patient's with acute exophthalmic goiter died suddenly a few hours after the onset of an ordinary follicular tonsillitis. No cause for the sudden death could be discovered in another similar case. suggests that as hypoplasia seems to be a constant necropsy finding in such cases, the acute Basedow develops only when the injuries resulting from excessive or perverted thyroid secretion affect a hypoplastic individual. In the absence of the tendency to hypoplasia, only the chronic form develops. The more stormy onset of the acute form is the result of the lesser resisting powers of the hypoplastic. The logical conclusion is that it is extremely dangerous to do an operation on persons with acute Basedow; every effort should be made to cure or at least to transform the acute into the chronic form, Schlesinger keeps the patient in bed, preferably in the open air. The food should be extra nourishing and digestible, avoiding sweets and much starch on account of the tendency to glycosuria. Among the adjuvants he mentions Röntgen ray exposures, the advantage from which in these dangerous acute cases far outbalances the possible harm from the development of connective tissue rendering more difficult any operation on the thyroid later. Very mild physical measures may also prove useful, including application of the continuous current to the neck.

Complications. J. S. Horsley and B. M. Rosebro<sup>7</sup> report a case of hyperthyroidism complicated by chronic appendicitis, retroversion of the uterus, and a bilateral cervical tear. The patient, up to the time of her first menstrual period in the hospital, did not present typical symptoms of hyperthyroidism, indicating that the chief cause of her trouble lay in the abdomen and pelvis.

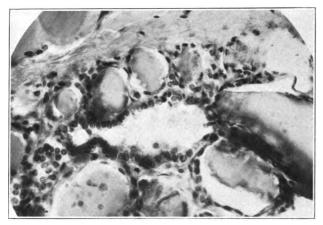
At her first menstrual period after she came to the hospital and after the operation she showed marked nervousness, tachycardia and tremor, which passed off in a few days. Accompanying each of these periods of thyroid activity the gland was tense. On account of her age and the fact that she would be compelled to return home to do hard work, it was decided to remove the hypertrophied portion of the gland in spite of the fact that the toxemia from the gland did not persist and that it was thought the gland was in a transitional stage. Her improvement after the operation was continuous and marked.

The patient was one whose past history pointed to considerable worry and mental stress for the last few years. In the case under consideration, there has probably been a slight enlargement of the thyroid gland for four years, and the extra demand made upon the thyroid on account of worry and nervous strain has caused an abnormal hypertrophy in order, not only to overcome the small diffuse goiter, but to meet the demands of the nervous strain.

The histologic picture of a simple goiter is that of a swollen acinus filled with stainable colloid and lined with flat, atrophied epithelium in single layers. Sometimes the epithelium has practically disappeared. The presence of symptoms of hyperthyroidism corresponds directly to the amount of epithelial cells that can be found in the thyroid. The more epithelial cells, the more thyroid secretion is produced, and the more marked the symptoms of hyperthyroidism. If the thyroid cells are small in

<sup>(7)</sup> N. Y. Mcd. Jour., Feb. 10, 1912.

#### PLATE XI.



Section from thyroid magnified 275 diameters. Central acinus shows absorbable colloid, abundant epithelium, and some folding in of walls of the acinus. While acini with stainable colloid and scanty epithelium are frequently met with in these sections, those showing the characteristics of the central acinus in the photomicrograph are too abundant to be accounted for by a mere compensatory hypertrophy and seem to correspond histologically with the clinical picture of the early stages of hyperthyroidism.—Horsley and Roselro. (Page 332.)

amount, there are no symptoms of hyperthyroidism, or if the epithelial cells are exceedingly deficient, there are symptoms of myxedema. (See Plate XI.)

Treatment. E. G. Blair<sup>8</sup> discusses the prognosis and treatment of goiter. He reviews the deaths in his experience which number 4 out of 56 operations, and concludes that early operation would have saved the patients. He reports gratifying results in the other cases and recapitulates his experience as follows:

1. There is no known medicinal cure for any form of

goiter.

2. Iodin can cause reversions, but cannot be regarded

as a cure, and in certain cases may do harm.

3. Thyroid extract is efficacious in suspending congestive and colloidal goiters; the result may be permanent.

4. The Rogers and Beebe serum is curative in 25 per cent. of serious cases and stands next to surgery in its results.

5. The x-ray does not result in cures. It does cause recessions, and its possibilities in a limited number of cases are not disputed.

6. Surgery holds to its credit the greatest number of permanent cures and is a safe and well-advised pro-

cedure if done at the proper time.

H. Matti<sup>9</sup> analyzes ten cases of exophthalmic goiter in which the patients died during or soon after an operation on the thyroid, and the thymus was found exceptionally large. He has compiled 133 similar cases from the literature; fully 76.5 per cent. of all the exophthalmic goiter patients who have died during or immediately after an operation on the thyroid had an unusually large thymus. It seems evident, he thinks, that the thymus and the thyroid act in concert and each aggravates the morbid condition induced by abnormal functioning of the other. Certain features of the cases suggest further that adrenal functioning is depressed by excessive or perverted thymus-functioning. In the ten cases reported the adrenals

<sup>(8)</sup> Jour. Mo. State Med. Assoc., February, 1912. (9) Deutsche Zeitschr. f. Chir., B. 116, p. 1. Abs. in Jour. Amer. Med. Assoc., Aug. 3, 1912.



were exceptionally small. It is possible that an operation on the thymus, accompanied by epinephrin treatment, might be a logical and useful preliminary to an operation on the thyroid for patients with exophthalmic goiter whose thymus is known to be enlarged. In any event, special caution is necessary with such patients.

Milk of Thyroidless Goats. W. Edmunds makes a further report on cases of Graves's disease treated with the milk of thyroidless goats, the results of which are inconclusive. He shows that the doses of the dried preparations given represent a much smaller amount of milk than that usually taken in the fresh state, and to give the equivalent of efficient amounts of fresh milk would cost about \$8.00 (33 s.) a day.

It is thought the symptoms of Graves's disease are due to excess of thyroid secretion in the circulation. Some experiments were made on this view. Rats were given doses of thyroideum siccum, half a grain twice or thrice a day, and were fed, some on the milk of normal goats and some on that of thyroidless goats. All the rats died from thyroid poisoning, but the rats fed on the normal milk lived longer than those fed on the thyroidless milk. This difference cannot be accounted for by any difference in the amount of calcium in the milk, because Cecil Revis found in an analysis that the amount of calcium was practically the same in the two.

The tremors of Graves's disease are certainly suggestive of the tremors which occur after total excision of thyroid and parathyroids, and as calcium is of immense importance in the treatment of these it seems advisable to give it in Graves's disease. The best way to do so is by giving milk, either cow's milk or goat's milk, but there is no strong evidence that the milk of a thyroidless goat is better than that of a normal goat. Moreover, the theory on which the "antithyroid" treatment is based is not above criticism; removal of the thyroid gland in goats must tend to produce, indeed sometimes it does actually produce, myxedema. This tendency should cause an antimyxedema body to be formed; this would be a pro-thyroid body and tend to make Graves's disease

<sup>(1)</sup> Lancet, Dec. 9, 1911.

worse. Again, Graves's disease is not infrequently followed by myxedema, and in some cases the symptoms of the two diseases coexist. It seems, therefore, probable that in long-standing cases we may have to treat not hyperthyroidism itself, but its permanent secondary effects combined very possibly with a certain amount of hypothyroidism.

The Relief of Obstinate Vomiting. J. A. Nixon<sup>2</sup> reports three cases of Graves's disease in which vomiting has become an alarming complication and dieting and drugs

seemed useless.

In the first two cases absolute confinement to bed with the use of the bed-pan, and strict supervision to ensure that the patient did not move hand or foot to supply her own wants, was combined with the administration of a substantial diet by mouth; milk, bread-and-butter, eggs, fish, chicken, broth, were freely given. At first the patients vomited at rare intervals, but within two days tolerance was established and the food retained. The patients soon discovered for themselves that the vomiting was produced by exertion or movement, rather than by a true inability to digest solid food; and having found this out they took their food with increasing confidence, and improved rapidly.

The third case was admitted to the Bristol Royal Infirmary with similar symptoms. The orthodox method of rectal feeding was adopted, and small quantities of milk given by the mouth; the patient continued to vomit, and her general condition became worse. A marked acidosis developed. Finally, on the fifth day after admission, the plan of dieting was changed, and the patient was given moderate meals of solid food; she vomited on three occasions more, and was after each promptly fed again. After two days of this treatment tolerance was established, the acidosis disappeared, the patient improved in every respect, and her danger from this symptom was

at an end.

It seems worth while to direct attention to this mode of dealing with obstinate vomiting in Graves's disease; the more so since the advice usually given and the

<sup>(2)</sup> Brit. Med. Jour., Nov. 28, 1911.

plan commonly adopted is to withhold food by mouth and resort to rectal feeding, a plan which he believes to be as useless in Graves's disease as it is in the vomiting

of whooping-cough.

Diet. Cohen<sup>s</sup> has found a diet consisting largely of raw or underdone broiled or roast beef and hot water very useful in many cases of exophthalmic goiter. From 250 to 500 c.c. of the water should be given about an hour before meals and ad libitum between them.

## THE PARATHYROID GLANDS.

Functions. W. G. McCallum' presents the evidence so far accumulated as to the functional action of the parathyroids, especially in the prevention of tetany. The following are the symptoms following the experi-

mental removal of the glands.

If the parathyroids are removed from an animal outspoken symptoms appear only after the lapse of a day or two, although in the meanwhile a gradual change in the excitability of the nervous system develops and finally reaches such a degree that its effects become evident in the form of muscular twitchings over the whole body, a curious fibrillary quavering of the muscle fibers of the tongue, tonic contractions of the facial muscle, which distort the face, of the laryngeal muscles, which produce a stridorous breathing, and of all the muscles of the body, which stiffen the limbs and trunk and render the animal awkward or helpless.

With this rigidity come more and more violent clonic convulsions of all the muscles,—the jaws snap, biting the tongue, and the whole body is thrown into the most intense spasms. So furious is the muscular work that the temperature quickly rises, and in the case of the dog there appears a most rapid panting respiration brought on by the reflex attempt to dissipate the heat. In an attack of this sort the animal may die or it recovers and lapses into complete fatigue, only to become again rigid and seized with convulsions. Other symptoms

 <sup>(3)</sup> Amer. Jour. Med. Sciences, 1912.
 (4) Jour. Amer. Med. Assoc., Aug. 3, 1912.

indicate disturbances of sensation and of the vasomotor system. Objective signs of the hypersensitiveness of the nervous system are shown by the electrical hyperexcitability of the motor nerves.

All workers have inquired as to the localization of the disturbance which produces all these symptoms, and it has been generally assumed, though not proved, that there must be some change in the circulating blood, since the affection is so general.

If, constantly testing the electrical excitability of the motor nerves, one cuts such a nerve during tetany, the muscle becomes flaccid and twitching stops, but the excitability of the nerve to the electric shock remains unchanged. If the nerve is cut and then the parathyroids removed, there develops gradually in the separated extremity of the cut nerve the same hyperexcitability as in the intact nerve of the opposite side. Obviously therefore some change in the circulating blood produces this change in the nerves. If we so anastomose the bloodvessels of an animal in tetany with those of the leg of a normal animal that the nerves of that leg are bathed with tetany blood, the nerves become hyperexcitable like those of the tetanic animal. If we reanastomose the femoral vessels with their own stumps in the normal animal so that the nerves of the leg are again bathed in normal blood, their excitability returns to normal. we bathe in the same way the peripheral nerves of one leg of an animal in tetany with the blood of a normal animal, their excitability becomes normal; while it returns to the tetany level if we reanastomose those femoral vessels with their own stumps and thus let the tetany blood flow through again. All this can be done by per-fusion from a bottle, and it is seen that whenever tetany blood circulates about the nerves they become hyperexcitable. Since normal impulses from the normal spinal cord produce no convulsions even through hyperexcitable nerve-endings (for it is the nerve and not the muscle which is hyperexcitable) and impulses from the cord of a tetanic animal produce no twitching through nerve-endings rendered normal by circulation of normal blood, it follows that spasms of the muscles must come only when

the ganglion cells send out abnormally violent impulses

to abnormally sensitive nerve-endings.

The chemical nature of this change in the blood is not known. It may be an active poison or it may be something which withdraws a moderating and quieting influence from the nerve-cells and leaves them in an unbalanced and hyperexcitable condition. There is much to say in favor of the latter view.

The administration of calcium will check these spasms, but the attempt to refer these conditions to changes in calcium metabolism have not yielded conclusive results. Nevertheless the hypothesis which is based on the wellknown observation that withdrawal of calcium from a cell, leaving a greater proportion of sodium and potassium, renders this cell hyperexcitable, is a tempting one and the facts rather tend to support it. On the whole, the idea that the symptoms of tetany are produced by the withdrawal of calcium from the cells, leaving them hyperexcitable, forms a plausible working hypothesis, supported by some facts and not detracted from by any cogent arguments. So it may well be that the change in the blood in tetany is caused by the presence of something which precipitates or renders useless the calcium of the nerve-cells.

There are experimental data that show vaguely some connection of the parathyroid with other organs. The production of glycosuria is influenced by the parathyroids, since it appears more readily on the injection of epinephrin after the extirpation of these organs than in the normal animal or in the thyroidectomized one.

In human disease the parathyroid plays a part, so far as we know, in the various forms of spontaneous and post-operative tetany and also in certain diseases which exhibit a disturbance in the process of calcification, such as osteomalacia and rickets. The relation of the parathyroids to other forms of tetany than the experimental and post-operative has been suggested rather than proved. Deficiency of calcium or hyperexcitability of the nerves may be due to other influences which the parathyroids are only partially able to counteract.

With even this slight knowledge of the nature of

tetany, several therapeutic measures have been suggested and put into practice with more or less success. Of course it is well known that gastric tetany can be relieved at once by gastro-enterostomy, that the tetany of pregnancy often stops on the delivery of the child and that infantile tetany may be cured by dietetic and hygienic measures, but in other cases in which the cause is not so plain, or in which the parathyroid glands have been destroyed, treatment is not so satisfactory.

As in the case of the thyroid gland, it has been attempted to replace the function of the parathyroid by administering an extract of the gland, and good results have been reported from this plan of treatment. In experiments with animals McCallum has not observed much effect from this method of administration.

Soluble calcium salts will stop the symptoms of tetany after parathyroidectomy very promptly if injected intravenously, and even if given by mouth in large doses, and it is possible in that way to keep such an animal alive for a long time. It does not cure the condition, however, but only masks the symptoms, which appear again when its effect is worn off. Its use must then be, like that of strontium or magnesium, to tide over in emergencies the period of danger, or in protracted cases of a milder type, to relieve the symptoms. Often, after an operation in which the destruction of the parathyroids has not been complete, the remnants will recover their function, and hypertrophy so as to be practically adequate to maintain health, and it is in this period of recovery that calcium may be especially useful. spontaneous cases of severer character, some writers have reported good results from its use, but others have observed no effect whatever. Implantation of the parathyroids may be successful.

In conclusion, then, it becomes evident that we are very imperfectly informed concerning the parathyroids. It is certain that they exercise a peculiar and very important function in preventing the appearance of an extraordinary change in the circulating fluids, which in turn produce an extreme hyperexcitability of the whole nervous system. What metabolic process is responsible

for this change we do not know, but it sometimes makes itself felt in spite of the parathyroid glands. There is much evidence that it produces or even consists in a disturbance in the metabolism of calcium which may well be the cause of the heightened nervous irritability. That the parathyroids control this is shown by the curative effects of injecting their extract or implanting them, and we must hope that in the near future we may be able to perfect this method so as to gain the mastery of the disease.

#### THE ADRENAL BODIES.

Functions. Swale Vincent<sup>5</sup> gives the following summary of views as to the probable functions of the adrenal bodies:

There have been two chief rival theories as to the function of the adrenal glands taken as a whole. These are the antitoxic and the internal-secretion theory. Since the discovery of the active principle of the medulla (adrenin) and the general recognition of the different origin, structure and chemical nature of the cortex and medulla, the antitoxic function has been chiefly assigned to the cortex, while the internal secretion has

been supposed to belong to the medulla.

There is considerable evidence, both anatomic and physiologic, to show that adrenin is the product of a secretory activity on the part of the chromaphile cells of the adrenal medulla, and that it passes by way of the adrenal veins into the general circulation, in order to assist the activity or maintain the tone of sympathetically innervated muscle and other tissue. It is interesting to note in this relation that the chromaphile cells of the medulla are derived from the cells of the embryonic sympathetic system. It is probable that the same function must be assigned to other parts of the chromaphile system.

There are some reasons for suggesting that the cortex may yield a hormone (possibly of the nature of a complex lecithalbumin, derived from the lipoid granules of the cortical cells), which influences the growth and nutri-

<sup>(5)</sup> Internal Secretion and Ductless Glands.

tion of certain tissues and organs, and especially the organs of reproduction. This theory may possibly find some support from the fact that the cortex is derived from the germinal epithelium. An antitoxic function has also been claimed for the cortex.

There is no evidence of sufficient weight to lead to the conclusion that there is any functional connection between cortex and medulla. On the other hand, there are reasons derived from comparative anatomy, embryology and pathology for believing that the internal secretion of the cortex is independent of that of the medulla; but we must not be too dogmatic on this point, for the ontogenetic and the philogenetic coming together of the two kinds of tissue may, after all, not be without some significance, which is at present unknown.

Several competent observers contend that, although the powerful active principle, adrenin, is obtained only from the chromaphile tissues, yet the cortex of the gland

is more essential to the life of the animal.

Hypo-Adrenalism. Conditions which indicate a deficient function of the adrenal glands, aside from Addison's disease, have been noted by some authors and may be classified as follows:

1. Those characterized by shock, gastro-intestinal symptoms, bradycardia, lumbar pain and death in a few days—a clinical picture somewhat resembling that of acute pancreatitis.

2. The asthenic type, in which the predominant feature is profound asthenia, ending in death within a few

days.

3. Cases of sudden death, in which the autopsy shows as the only adequate morbid change a destructive lesion, usually hemorrhagic, of the suprarenal gland.

4. A nervous type, marked by convulsions, coma or

delirium, with muscular twitchings.

Another type of doubtful nature is one characterized by hemorrhage into the suprarenal glands with hemorrhagic eruptions in other abdominal viscera and the skin.

D. Riesman's reports four such cases. In the first there

<sup>(6)</sup> Jour. Amer. Med. Assoc., June 15, 1912.



was a very marked myasthenia and a persistently subnormal temperature and slow pulse. The respirations
were ten to twelve per minute. At the end of ten days,
when recovery from the general muscular weakness was
almost complete, a left-sided facial palsy developed
and lasted ten days. Recovery was complete in about
two months. It is the author's view that the facial palsy
was not directly connected with the asthenia. The other
cases had in common a sense of physical weakness,
amounting to actual prostration, a feeling of coldness, a
subnormal temperature, and in two cases slow pulse and
low blood-pressure. Recovery was prompt in the two
recent cases within three or four days.

The author believes that the cases reported are best explained on the view that there was a functional insufficiency of the adrenals by which the body was temporarily deprived of its proper meed of adrenal secretion. Theoretically we might conceive, instead of a deficiency of the hypertensive epinephrin, an accumulation in the blood of hypotensive substances, the existence of which has been predicated by Abelous and Langlois, Pearce and others. But in doing so we increase rather than lessen our difficulties. It is much simpler to blame the adrenals, or perhaps the entire chromaffin system, the fons et origo of the substances maintaining the general vascular and muscular tone.

The symptoms of non-fatal hypo-adrenalism may be described as those of mild shock—subnormal temperature, great muscular weakness, coldness of surface and low blood-pressure. The pulse is usually slow; the duration variable—from a few days to a few weeks. It is doubtful whether our present tests for epinephrin in the blood are delicate enough to determine the existence of such a state as described, but where laboratory facilities are at hand such tests might readily be made. Rest and the administration of suprarenal extract—5 gr. two or three times a day—is the treatment that naturally suggests itself for temporary hypo-adrenalism.

It is more than likely that the first case, in which the myasthenia reached a grave degree, was also dependent on adrenal insufficiency. The glandular theory of myasthenia gravis has been advanced by several writers in recent years (Zudemans, Raymond and Massolongo); the tendency at present is to look on the condition as dependent on disturbances not only of the adrenal but also of other glands of internal secretion. There is still, to be sure, much theory and little fact, but the hypothesis is attractive and may prove fertile.

#### THE PANCREAS.

The Islands of Langerhans. Since the views of Opie were published, the opinion has prevailed to a large extent among pathologists, that the islands of Langerhans are the special place of manufacture of the internal secretion of the pancreas and have a special relation to the production of diabetes. Later investigations have thrown doubt on the independent character of these structures.

According to Swale Vincent, modern writers may be divided into two chief groups, according to their views as to the morphologic significance of the islets. The first of these believe that the islets are essentially of the same embryologic and morphologic nature as the zymogenous tubules, and are not to be looked upon as, in any sense, organs sui generis. The second group of observers regard the structures in question as definite and distinct organs, analogous to the cortex of the adrenal, the epithelial part of the pituitary body and the parathyroids, and consider that they have no connection (except a community of embryonic origin) with the secreting tubules of the pancreas.

Vincent and Thompson were the first to prove experimentally that the islets of Langerhans actually pass through a structural cycle, corresponding to a cycle of changes in physiologic conditions. They were able to provoke experimentally the formation of new islets at the expense of the exocrine parenchyma, and then to induce their disappearance by a new transformation into acini.

icini.

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Similar results have been reached by Laguesse. This

<sup>(7)</sup> Internal Secretion of Ductless Glands.

view has now at last been accepted by some modern writers of text-books. Adami affirms that he has encountered appearances in the human subject which would be difficult to explain, except on the hypothesis that the islands are not separated organs; that they vary in number, according to the state of nutrition and activity of the gland, becoming converted into active acini, and vice versa. As Adami justly points out, these observations do not wholly negative the contention that the islands bear some intimate relationship to a certain order of cases of diabetes; they suggest, however, that degenerative changes seen in them are an indication of the other changes occurring in the intimately connected pancreatic tissue proper.

Whatever may be subsequently discovered to be the true function of the islets of Langerhans, their intimate anatomic relationship with the zymogenous tubules, the numerous transition forms in all groups of vertebrates, and the transformation of alveolus into islet, and vice versa, all appear to prove conclusively that the islets are not organs sui generis, but are an integral part of the pancreatic tissue. As to whether the temporary structural modification of alveolus into islet tissue corresponds to a specialization of function, the evidence is at present inconclusive.

# THE HYPOPHYSIS.

Endothelioma of the Hypophysis. G. E. Rennie<sup>8</sup> describes a case of endothelioma of the hypophysis in a boy of 16 years, with a history of headache for some considerable time, accompanied by a feeling of drowsiness and disinclination for any kind of food, with some wasting. The diagnosis in Rennie's case was extremely difficult, and the only points to guide him were the high arterial tension, the large amount of pale urine of low specific gravity, the headache and vomiting. absence of optic neuritis and any localizing symptoms of brain tumor a diagnosis of chronic interstitial nephritis was made. The patient was discharged from the hospital

<sup>(8)</sup> Brit. Med. Jour., June 8, 1912.

slightly improved in general health. He remained in fair general health till readmission to hospital in August, 1909. He had not apparently grown in height or developed but he was about 2 pounds heavier. He complained still of headache and occasional vomiting of cerebral type. His memory was defective and had been getting worse for the last year. He was quite intelligent, but could not fix his attention. Headache was constant day and night; it disturbed his sleep, and was made worse when he tried to read. Everything seemed a trouble to him. The pupils were small and equal; they reacted to light and convergence and the ocular movements were normal. Examination of the media showed a post-neuritic atrophy in both disks, and investigation of the fields of vision revealed a very definite bitemporal hemianopsia. His vision was 6/9 in each eye. There was no other cranial nerve affection.

His muscular power was feeble, as all his muscles were but poorly developed; he could not walk except with assistance as he tended to fall backwards. There was no disturbance of sensation. His knee-jerks were increased. more so on the right side than the left; there was no ankle-clonus and the plantar reflex was flexor in type. There was now no excess of urine; it was alkaline, specific gravity 1.020, and contained no albumin and no sugar. His temperature on admission was subnormal, pulse 90 and respiration normal. Six days later he had two or three fits, in which he became completely unconscious. breathing stertorously and sweating profusely. limbs became rigid, the reflexes were exaggerated, and a Babinski reflex was present on both sides, but was easily exhausted. He had incontinence of urine during the fits. The temperature rose to 103°F, and remained high for some days, varying from 99.8° to 105°F. Lumbar puncture furnished some cerebrospinal fluid which did not escape under pressure and microscopic examination showed only a few lymphocytes, but no organisms; the fluid was sterile on culture. There was marked prostration, with dry brown tongue, sores on the lips and general hebetude.

From this state he gradually recovered, but there was a

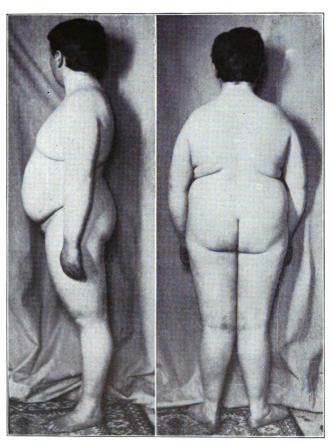
definite weakness on the right side and on his discharge from the hospital there was ankle-clonus on the right side and double Babinski reflex. He died in his own home a few months later, but he was seen at intervals from the time of his discharge from the hospital up to the time of his death, and no material change took place in his condition. The pituitary gland was replaced by a large neoplasm, the size of a large walnut. Histologic examination showed that the growth was an endothelioma, which had invaded the gland and only very little of the glandular tissue remained. It was not possible from examination of the tissue to say which lobe of the pituitary gland had been first invaded.

Acromegaly and Infantilism. A. Bittorfo presents two cases showing various phases of disturbance of the hypophysis. The first was a case of acromegaly. condition is admitted to be the result of an increased function of the glandular part of the hypophysis. A striking feature of this case was a binasal hemianopsy, while in the majority of cases a bitemporal hemianopsy is observed. The positive reaction to the Wassermann test indicated that the disease of the hypophysis was of a luetic nature. The case also presented an alimentary glycosuria which is a frequent symptom in acromegaly, but there was no spontaneous glycosuria and polyuria, although this sometimes occurs. The author also calls attention to the peculiar blood-finding of eosinophilia and lymphocytosis. These are frequent findings in diseases of the glands with internal secretion, and indicate the hyperplasia of the lymphatic system which occurs in the course of such diseases and has been especially emphasized by the author and Hedinger in Addison's disease.

The second case was a girl of sixteen whose principal complaint was rheumatic pains but who also exhibited a defective vision and occasional temporary attacks of vertigo. The examination showed an obese girl of infantile habitus without any trace of pubic or axillary hair and the mammary glands showed no evidence of a glandular portion. The uterus was infantile and the patient had not menstruated. A Röntgen picture of the base of

<sup>(9)</sup> Berlin. klin. Wochenschr., June 3, 1912.

#### PLATE XII.



Lateral view of patient. Note the obesity, lumbar lordosis, small hands and feet.

Posterior view of patient. Notice genu valgum and the distribution of fat on the body.

—Hewlitt. (Page 347.)

the brain showed a marked increase in the sella turcica. This case is probably an example of infantilism in consequence of a faulty development and insufficient function

of the hypophysis.

The connection of imperfect development of the genital organs with disease of the hypophysis or hypofunction of the gland has been frequently observed. In these cases the evidence points to a primary defect of the genital organs in a number of cases in which the imperfect development of the reproductive system precedes by a considerable time the defective condition of the hypophysis. In such case the imperfect development of the genital organs must be attributed to a lack of the internal secretion of the ovaries or testicles to which the imperfect function of the hypophysis is accessory. In most cases. however, the primary disturbance seems to be found in the hypophysis. In this case eosinophilia was marked as well as a tendency to obesity. Alimentary glycosuria, on the other hand, was lacking. The use of thyreoidin and ovarian extract was followed by a marked change in the condition of the blood, both lymphocytes and eosinophiles being increased.

Types of Infantilism. Various definitions for this condition have been proposed. A. W. Hewlitt¹ quotes the following description of the Brissaud type: "Round, chubby face, lips projecting and plump, small nose, smooth face, fine, clear skin, fine hair, eyebrows and eyelashes scant, eyes prominent, large, round cheeks, infantile face and head, skeleton underdeveloped, neck short and chubby, body long and cylindrical, abdomen prominent, limbs round and large, layer of fat over the whole body, infantile pelvis, lumbar lordosis, rudimentary sexual organs, no hair except on head, high-pitched voice, thyroid small, mind slow, retardation of ossification, absence of retardation of second dentition." (Plate XII.)

The Loraine type of infantilism is described as follows: "Small stature, delicately formed, slender skeleton, skin soft and pale, large shoulders, lower extremities long and slender, trunk relatively small, infantile sternum and pelvis, epiphyses normally united, no fat, abdomen nor-

<sup>(1)</sup> Archiv. Int. Med., Jan. 15, 1912,

mal, finely chiseled face, voice high, neek long, genital atrophy, absence of or slight secondary sexual characteristics."

Hewlitt reports three cases and draws the following conclusions:

1. The infantilism associated with disease in or near the pituitary gland may resemble either the Brissaud or the Loraine type of infantilism.

2. A constantly low specific gravity of the urine in patients with such disease may be the equivalent of a mild diabetes insipidus.

# DISEASES OF METABOLISM.

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#### Gour.

Atophan. Retzlaff<sup>3</sup> recommends the use of atophan (phenylchinolin-carbonic acid) in gout in doses of 2 to 3 gm. continued for 4 to 5 days, from which he notices the following effects. There is a rapid diminution in the pain and tenderness of the joints, and a favorable action on the general condition of the patient. The inflammation is lessened and the swelling of the affected joints is reduced. The author has noticed no unfavorable side effects except in a few cases, and it was never necessary to suspend the remedy. If symptoms such as pressure in the stomach and heartburn become distressing, the recommendation of Weintraud to give sodium bicarbonate with the dose of atophan is to be recommended. In case of nephritis the same addition should be made.

The times immediately before and after the attack are very favorable periods for the administration of the drug. By examination of the uric acid curve the depression in the excretion preceding the gouty attack can be detected, and this forms an indication for the administration of atophan. The author believes that by the administration of the remedy before the oncoming of an attack a prophylactic influence may be exerted and the maximum of uric acid elimination with the minimum of the remedy obtained

# ARTHRITIS DEFORMANS.

Etiology. R. Oppenheim and P. Lamy' call attention to the probable tuberculous origin of some of the cases of arthritis deformans. They report the results of the

<sup>(3)</sup> Deutsche med. Wochenschr., Feb. 29, 1912. (4) Prog. Méd., July 27, 1912,

intradermic application of tuberculin in a number of hospital patients with various diseases, and they found 77 per cent. of positive reaction, a figure which closely approaches that of 74 per cent. which they found as the result of necropsy. Among these cases of old men there were 55 with chronic arthritis deformans; 54 of these gave a positive reaction, more than 98 per cent. The authors admit that in a large proportion of these cases it is probable that the tuberculosis was associated with the arthritis but not in an etiologic way. They call attention, however, to the fact that the same proportion of tuberculous patients was not found among those with other diseases.

The subcutaneous injection of tuberculin in a number of patients affected with arthritis deformans gave a positive febrile reaction which was accompanied by a painful reaction in the affected joints, although there was no external appearance of any change, such as swelling or hydrarthrosis. Believing that these cases might be affected or complicated by tuberculosis, the authors attempted to treat them with tuberculin.

They sum up their results as follows. In two cases there was a manifest amelioration; in four, a slight but permanent improvement; and in two others, a slight but transitory improvement; while in the ten other cases there was no result. No exacerbations were noted as due to the treatment, the authors refusing to consider as such the attacks of arthralgia which are frequently noticed after the injections and which have the characters of a local reaction; these were noted even among patients who improved under the treatment. In five cases, however, they assumed a certain severity, but these were always of short duration, two to three days as a maximum. Moreover, these pains could be avoided by recourse to a very slow increase in the treatment in patients that seemed predisposed to them.

In two cases the authors noted the disappearance of subacute attacks of rheumatism with elevated temperature, periarticular swelling and sharp pains which were accustomed to recur periodically before the treatment. In six cases the improvement was considerable, and espe-

cially in two quite severe cases of which the authors give a somewhat detailed history.

In closing, the authors refer to the view that the failure to receive benefit from the tuberculin treatment is evidence that the rheumatism was not of a tuberculous nature. To this it may be objected that it is not yet proved that tuberculin is beneficial in all forms of tuberculosis; and especially it ought to be shown that all the cases of tuberculous rheumatism are due to the toxins of the tuberculin group, to the exclusion of other poisons of microbic origin, such as the poisons adhering to the body of the bacilli, the ethero-bacilline, chloroform bacilline, etc., to which Poncet tends to assign an important rôle, and against the action of which we as yet possess no process of immunization.

With these exceptions they believe that their results, as well as those obtained by Hollos and Biro, permit the hope that a certain number of patients affected with progressive arthritis deformans may be improved if not cured by tuberculin treatment. Since it is not possible in the majority of cases to establish with certainty the diagnosis of tuberculous rheumatism, the trial of this treatment in all patients who have not been improved by the usual form of treatment, and who have reacted positively to a diagnostic tuberculin test, is to be recommended.

Treatment. H. M. Greene<sup>5</sup> reports a case of arthritis deformans beginning in the right wrist and gradually extending until it had involved all the joints of the body. The author found all the joints of the extremities greatly enlarged and partly ankylosed. The movement of the jaw was so limited that he was not able to put his false teeth into his mouth. Bacteriologic examination showed two distinct organisms, a bacillus which was similar to the one described by Ballantyne, Wohlmann, and Bloxall, and a diplococcus, probably the same as Boynton and Payne had isolated from the synovial membranes in chronic arthritis.

A bacterin was prepared from these organisms and treatment was instituted with remarkable results, in the view of the author. After two weeks the man was able to

<sup>(5)</sup> N. Y. Med. Jour., Aug. 31, 1912.

sleep without disturbance during the night and stated that his pain had entirely left him. The mobility of the wrist and jaw were much increased.

### DIABETES MELLITUS.

Glycosuria. A. E. Garrode calls attention to many different morbid conditions which bring about disturbances of the metabolism of carbohydrates and to the fact that such disturbances manifest themselves in several different ways: now by a lowering of glucose tolerance without actual excretion of sugar in the urine; now by a spontaneous excretion of sugar in smaller or larger amount during limited periods of days, weeks, or months; and now by a persistent glycosuria, accompanied in its higher grades by the associated symptoms which go to make up the clinical picture of diabetes. Disturbances of these several grades may be induced in different cases by one and the same cause, or in the same case at different times.

The effect of this is to obliterate the conception of diabetes as a sharply defined disease, and to present the malady as merely the maximal phase of a series, rising by gradual steps from the normal of metabolism, just as myxedema is the culminating point of the almost insensible grades of hypothyroidism. Between the sufferer from grave diabetes and the potential glycosuric there is a striking contrast, but the gulf which separates them is bridged over by intermediate cases of all degrees of severity. If so, it follows that, with the possible exception of the so-called renal glycosuria, there is no such thing as non-diabetic glycosuria, although there are many varieties which lack the sinister import which we connect with the name of diabetes. The differences are rather of degree than of kind. A transient glycosuria is not necessarily of grave import, and diabetes is not of necessity a fatal malady.

Many organisms take part in the carbohydrate metabolism, and disturbance of one may endanger the equilibrium of the whole fabric. The normal metabolic level is

<sup>(6)</sup> Lancet, March 9, 1912,

maintained by the balance of a number of mutually controlling forces. In some instances the lesion of one of the supports of the fabric is capable of repair, and with its restitution the disturbance ceases and the normal condition is restored. In other instances the damage is beyond repair, and in time brings down the whole structure. We may imagine that in some individuals, as the result of inborn peculiarities, the equilibrium is less stable than in the majority, is upset by more trifling causes, and when upset is less easily restored. These are the people who inherit or possess the diabetic tendency.

While it is true that in some cases of diabetes the nervous system is evidently at fault, and that in others the thyroid, the pituitary, or the pancreas is the seat of disease, in the great majority of cases which we encounter in practice we can find no indications of the underlying lesion upon which the metabolic derangement depends. The various tests of pancreatic efficiency give uncertain or negative replies; no ductless gland is evidently the seat of disease; no intestinal disturbance points to an origin in the alimentary tract, and no cardiovascular changes help us to class the case. There is, to all appearance, a sheer, wanton, metabolic insanity. Nevertheless, we can hardly doubt that in such cases there is an underlying morbid cause at work, if only we could find it out, and that if we follow up minutely every clue and every deviation from the normal we shall surely see light in time.

It is highly probable that in most instances the primary lesion is not amenable to treatment, either medical or surgical, but a certain control can be exercised over the metabolism which will render the outlook of some diabetic patients less hopeless than it is at present. Only when we have learned more of what lies behind the diabetic syndrome can be hope to attain to better therapeutic methods. Then will our present dietetic treatment be relegated to its true position as a valuable means of holding in check the metabolic error and minimizing its evil effects, while our main efforts are directed to the repair of the underlying lesions, so far as they admit of repair.

Pancreatic Changes. D. von Hansemann' concludes an investigation of the changes in the pancreas in diabetes as follows. Pancreatic lesions are found regularly in cases of genuine diabetes, but not in every form of glycosuria. Diabetes must be regarded as a disease depending on the internal secretion of the pancreas. He concludes further that the islands have no significance for this process, because they are changeable structures and constitute an especially variable form of the paren-

chyma.

Diagnosis. The following hints as to the diagnosis of diabetes are given by M. Kaufmann.8 When an examination of the urine has shown the presence of sugar it has not been certainly established that we have to do with a genuine diabetes: it may be merely an accidental. temporary glycosuria. The patient is, therefore, allowed to continue his accustomed diet without limitations and required to bring a sample of his urine collected for 24 hours. If we find sugar again the diagnosis of a diabetes is assured; but if the test is negative the patient is required to bring at a later day a sample of the urine passed at each micturition. In mild forms of the disease it is often the case that not every portion of the urine contains sugar. If one examines each portion separately he will find the sugar in some specimens, but if all are mixed together, as, say, five free from sugar and one containing it, the dilution is so great that the mixed urine no longer gives a reaction for sugar and it may be erroneously concluded that the person is free from sugar. This is not merely a theoretic source of error, but is a daily occurrence not commonly known.

In this connection a word should be said about quantitative estimations of sugar. It seems unnecessary to caution against the obvious error of making the examination for the quantity of sugar on a portion of the urine taken ad libitum. An especially favorite method with physicians is to take the urine passed on rising, but the different portions of urine often vary markedly in their content of sugar, and in mild cases it may happen that

<sup>(7)</sup> Berlin. klin. Wochenschr., May 13, 1912.
(8) Zentralbl. f. d. Gesamte Therap., May, 1912.

one or the other sample is entirely free from sugar, and this is especially frequent in the urine passed on rising. It must be therefore regarded by the physician as an unconditional requisite to select for examination the mixed urine for 24 hours, and, of course, the total quantity of urine must be known. The measurement of the daily quantity can easily be done at home. Scientific exactness is not required. A convenient vessel for measuring urine can easily be constructed by selecting a two-liter or two-quart jar and measuring into it a definite quantity of water, say, 4 ounces or 100 c.c. and marking on the outside of the jar the level reached by each separate addition.

Test for Aceto-acetic Acid. B. v. Ondrejovich describes the following test for aceto-acetic acid in the urine. To 5 c.c. of urine 5 drops of 50 per cent. acetic acid are added. A 2-per-cent. methylene blue solution is then added until the whole assumes a pronounced blue color, for which purpose a drop is usually sufficient. Then 4 drops of tincture of iodin are added, which give a red color to the entire mixture. However, if aceto-acetic acid is present, the mixture becomes blue or green again, at the latest in a minute. If the aceto-acetic acid is not present, the mixture retains its red color.

This reaction is well suited to the quantitative estimation. For this purpose one may conclude that there is a large amount of aceto-acetic acid, if, after the adding of the iodin, the red color entirely disappears or remains visible only a short time. In this case we may add the tineture of iodin drop by drop until the mixture becomes either blue or green within a minute. The number of drops of tineture of iodin used is proportional to the amount of aceto-acetic acid present. The author enumerates the following advantages:

1. It is rapid, uncomplicated and reliable. 2. Salicyl compounds and antipyrin do not give it. 3. It gives a negative result in the absence of aceto-acetic acid, but in the presence of other constituents, like grape-sugar, acetone, beta-oxibutyric acid, glycerin, lactic acid, bile and creatinin. Iodin and acetic acid precipitate albumin,

<sup>(9)</sup> Deutsche med. Wochenschr., July 25, 1912.

but this circumstance does not hinder the reaction. 4. The phosphates are not precipitated. 5. The reaction is more sensitive than all the hitherto known tests for aceto-acetic acid. 6. It is well adapted to quantitative estimations.

It must be noted that this reaction, like others, fails after boiling or after the action of a large amount of formaldehyd for a long time, in consequence of the

decomposition of the aceto-acetic acid.

Acetonuria. C. C. von Noorden¹ gives an account of the metabolic changes which result in the presence of the acetone bodies in the urine. These, as it is well known, occur in fever, starvation and other conditions in which the supply of carbohydrates is cut off or greatly diminished. They are found in diabetes, especially in the severer forms, and in cases in which a carbohydrate-free diet has been instituted. These bodies are formed in the liver and are an indication of a lack of glycogen in the liver. The explanation of their formation seems to be that in the presence of glycogen the fatty acids are capable of metabolism without the formation of the acetone bodies, but in the absence of glycogen this metabolism cannot occur and the acetone bodies are formed.

It is a striking fact that in ordinary cases the amount formed is greatest at first and rapidly diminishes. Probably this is due to the fact that when carbohydrates are removed from the diet the amount of glycogen in the liver is soon exhausted and it takes some time for the liver cells to accommodate themselves to the new condition of things. During this period the acetone bodies are formed, but when the cells have gained the power to form glycogen from the proteins or amino-acids the glycogen checks the production of the acetone bodies so that their amount rapidly diminishes. In the case of the diabetic, however, the formation of sugar is so rapid that glycogen is not deposited in the liver; hence the formation of acetone bodies is more or less continuous. especially if the supply of carbohydrate is limited. In mild cases of glycosuria, where the patients are taking

<sup>(1)</sup> Wien. med. Wochenschr., July 6, 1912.

a mixed diet containing carbohydrates, the acetone bodies are uniformly absent from the urine. On the adoption of a strict carbohydrate-free diet the amount of sugar in the urine is reduced, but acetonuria is developed. This acetonuria is entirely physiologic. Any healthy person would have exhibited it under the same diet. After patients with such glycosuria have become accustomed to a carbohydrate-free diet, the acetonuria disappears, so that in the later periods of such a mild glycosuria no acetonuria will be found.

There are also some cases of such glycosuria in which a mild acetonuria persists. Some of such cases are harmless, particularly when they are met in advanced life. Also no great stress is to be put on the fact that a pregnant woman with mild diabetes exhibits also acetonuria. Pregnant women are inclined to acetonuria, and it is shown by experience that the height of the formation of acetone bodies depends largely on the personal equation. If a person who is inclined naturally to a large formation of acetone bodies is affected with diabetes, values of the acetone bodies may readily be found which will disturb the physician; and it requires often a long and thorough study before one can say that it is not a dangerous pathologic formation, but a harmless, although unusually high physiologic acetonuria.

In young diabetics a permanent acetonuria of 2 decigrams and more should be regarded with the greatest distrust. Such patients in this stage of their disease bear a certain amount of carbohydrate, such as 80 to 100 gm., if distributed in small portions throughout the day. They then remain free from sugar, but the urine gives a positive reaction for acetone. We must take this as an indication that the power of retaining glycogen in the liver has already suffered a serious diminution. In some of these cases the author has had an estimation of the sugar in the blood made and, as was to be expected, found a considerable degree of hyperglycemia. The explanation of the absence of sugar from the urine is found in the fact that in certain diabetics, even when there is no nephritis, the kidney is less permeable to sugar than normal. Such cases offer a very unfavorable prognosis. In such cases the author recommends a strict diet and the administration of alkali sufficient to ensure the elimination of the acid products of metabolism.

In the severer cases of diabetes, acetonuria occurs whenever carbohydrates are removed from the diet. These cases can be divided into two classes: first, the administration of some carbohydrates, while it increases the amount of sugar, secures a freedom from the presence of acetone bodies. The influence of different carbohydrates is quite variable. The administration of oatmeal in some cases reduces the amount of acetonuria without any marked increase in the glycosuria. Von Noorden calls attention to the fact that a reduction in the acetonuria can often be attained in one of two ways, either by the permission to use carbohydrates, to which the patient has become accustomed, or by the adoption of a strict carbohydrate-free diet under which the disposition to the formation of acetone bodies gradually disappears, and the toleration of the patient for carbohydrates increases. The explanation of the disappearance of the acetone bodies in diabetic patients when carbohydrates are allowed is that the power to retain carbohydrates in the liver for a time is not completely lost, so that there is a certain deposition of glycogen that serves to prevent the formation of the acetone bodies.

Von Noorden warns against the simpler, more pleasant way of allowing the carbohydrates in cases in which it is possible for the patient to be placed on a strict diet without danger. This method tends to reduce the tolerance for carbohydrates, whereas the strict diet not only improves the carbohydrate tolerance but lessens in the end the tendency to acetonuria.

In other cases the tendency to acetonuria is so great that a restriction of the carbohydrates results in the occurrence of marked acidosis and a tendency to a dangerous amount of acetonuria. These cases afford no prospect of an increase of carbohydrate tolerance or a reduction to a milder form. The withdrawal of carbohydrates in such cases is not permissible. Occasional days of starvation and rest in bed give favorable results.

Treatment by Alkalies. Von Noorden advises in cases of medium severity the giving of moderate doses of alkalies, amounting to about 15, or at the highest 20 gm. per day. Where there is no immediate danger of acid intoxication he regards doses as high as 40 to 60 gm., which have been sometimes recommended, as quite unnecessary. He mentions cases in which such administration of alkali was accompanied by a very severe and annoying hyperacidity of the stomach. The doses which he recommends are 5 gm, in the morning and 5 gm, in the evening of sodium bicarbonate, the remaining 5 gm. being given in a bottle of mineral water distributed throughout the day, but in no case given with meals. Sodium citrate may be used in place of sodium bicarbonate, and as it has a slight laxative action it is frequently preferable. The alkaline earths, such as calcium carbonate and magnesia, are seldom available for counteracting acidosis, as they are absorbed only to a slight extent. When larger doses are necessary they must be given usually either by the rectum or by means of intravenous injections. The author calls attention to the importance of removing constipation, which may of itself be a cause of acidosis.

In addition to the dietetic measures which have been previously mentioned, the use of levulose is to be recommended as being less harmful to diabetics than other sugars. In addition the author has found in certain cases that the removal of all other forms of food and the administration of large amounts of alcohol greatly diluted are of marked benefit. As much as 100 to 150 gm. per day can be given. According to his experience the rapidity with which the acetonuria will decrease and the patient's general condition improve under this treatment is astonishing. When improvement has been secured by one or two such alcohol days, other food should be given, and the ordinary diet gradually restored. The prognosis of such cases is very serious, and treatment in the stage preceding coma is practically hopeless. This affords the greater reason for a rational treatment of acidosis in its earliest stage.

Oatmeal Diet and Water Retention. M. Mirowsky 2 reports some interesting observations on the relation between the administration of oatmeal and the sudden increase of weight sometimes observed, due to the retention of water in the tissues. This does not seem to depend on the oatmeal alone, but occurs especially in connection with the simultaneous administration of sodium bicarbonate. It does not occur in non-diabetic patients, nor in those affected with diabetes insipidus. Neither is it due to the action of sodium bicarbonate alone even in diabetes. The phenomenon is evidently closely connected with the oatmeal whose carbohydrate element acts so differently from those of other cereals. The vessels and tissues of diabetics must be especially favorable to the retention of water, which takes place especially when the stimulating influence of the sugar in the blood is lessened by the use of oatmeal instead of other carbohydrates.

Oatmeal, and Sugar in the Blood. H. Schirokauer<sup>3</sup> has investigated the influence of an oatmeal diet on the amount of sugar in the urine and in the blood, in patients who were in fairly good health, although showing a considerable glycosuria on ordinary diet and only traces on a strict carbohydrate-free diet, with no indication of serious acidosis. The author sums up the results

of his researches as follows:

Case 1 was an old diabetic who excreted 2.8 per cent. of sugar in the urine on a diet containing 75 gm. of carbohydrate, and excreted the entire amount ingested. The sugar in the blood amounted to 0.46 per cent. On a strict diet with two vegetable days the urine became free from sugar without any noticeable acidosis. The amount of sugar in the blood was reduced to 0.190 per cent. In the oatmeal period, in which 160 gm. of carbohydrates were introduced as oatmeal, the urine showed only a slight amount of sugar, varying between 0.2 and 0.6 per cent. Following the oatmeal period the amount of sugar in the blood was again 0.190 per cent. and the next day there was 0.2 per cent. of sugar in the urine.

 <sup>(2)</sup> Deutsche med. Wochenschr., March 7, 1912.
 (δ) Berlin. klin. Wochenschr., June 10, 1912.

This case shows a thickening of the urinary filter for sugar in the course of diabetes. The urine became free from sugar, while the amount of sugar in the blood was still abnormally high. However, in spite of the large amount of carbohydrate ingested, the sugar in the blood did not rise above the point which it had reached under a carbohydrate-free diet. While the amount of sugar in the urine under carbohydrate-free diet was nothing, under the oatmeal there was a slight glycosuria.

In the second case there was diabetes, associated with a diffuse chronic nephritis. Examination of the blood showed a constantly high value of sugar, while the urine was constantly sugar-free. On a strict diet the amount of the sugar in the blood was reduced to normal without any notable acidosis. In the oatmeal period with an ingestion of 160 gm. of carbohydrate the amount of sugar in the blood rose, but in spite of an introduction of more than twice the amount of sugar-formers, the former value, reached on a diet of only 75 gm. of carbohydrates, was not attained.

In the third case a similar increase of sugar in the blood was found on the use of the oatmeal diet, but the height reached was very moderate compared with the previous figures. The urine contained small amounts of sugar. Acidosis, which was formerly present, disappeared completely. On the addition of bread the amount of blood-sugar reached nearly its former height, and the glycosuria varied between 0 and 0.12 per cent.

In the fourth patient from 2 to 3.4 per cent. of sugar was excreted in the urine with 75 gm. of carbohydrate. On a strict diet the glycosuria disappeared completely with only slight acidosis, but the sugar of the blood reached the high value of 0.182 per cent. After a five-day vegetable period the amount of blood-sugar was below the normal. The oatmeal diet caused a disappearance of the acidosis and made the urine free from sugar, but the amount of sugar in the blood was 0.15 per cent.

The result of the author's examinations, then, is that in spite of the increased quantity of carbohydrate ingested as oatmeal, the rise in the amount of sugar in the blood was insufficient to account for the increased amount of carbohydrate. A comparison of the influence of potatoes with that of oatmeal shows that their effect on the tolerance of carbohydrates is practically the same. The rise in the amount of sugar in the blood is somewhat greater with the potato diet than with the oatmeal, but not greater than with the strict carbohydrate-free diet.

The author believes that his researches indicate the importance of taking into account the amount of sugar in the blood in the investigation of the phenomena of

diabetes.

Rice Diet. H. Stern<sup>4</sup> has studied the use of rice in

diabetes and draws the following conclusions:

1. Rice, i. e., the "polished" product of commerce, furnishes substantially nothing to the organism besides an easy digestible starch. Given in suitable amounts this starch is practically all absorbable and ready to serve as a calorifacient.

2. The commercial cereal is therefore peculiarly adapted to supply carbohydrates without any protein or

mineral admixture of consequence.

3. This deficiency of protein and mineral substances makes rice an indifferent food so far as the formation of toxic protein products, and useless or impossible so far as pancreatic, cardiac and renal activities are concerned.

4. The mineral and protein deficiency of rice facilitates the reduction of salts and the calculation of absorbable albumin necessary at every stage of the diabetic affection. (The elaboration of proteins from cereals and leguminous seeds by the healthy organism is mostly incomplete; it is impossible, or nearly so, in every case of advanced diabetes.)

5. Rice, being nearly entirely absorbable, only a comparatively small quantity of it is needed by the diabetic organism; it is not the purpose of the rice to supply the total food requirement as does v. Noorden's standard oat-diet; the cereal may be incorporated with any properly adjusted protein-fat combination.

6. Contrary to the oat diet, rice as a single form of carbohydrate and in suitable combination may be em-

<sup>(4)</sup> Med. Becord, June 29, 1912,

ployed by the diabetic for more protracted periods; it may be prepared in a number of different ways and forms that prevent monotony and always furnish a palatable dish for the patient.

7. Sixty gm. of the absorbable starch granule of rice generally produce the anti-acetonemic effect of 250 gm. of the but partly absorbable oats in the standard admix-

ture.

8. Pronounced cases of acidosis are frequently sup-

pressed by the ingestion of 100 gm. of rice.

9. The amount of rice requisite to depress the acetonuria does not necessarily increase the intensity of the glycosuria. In a large number of cases the glycosuria will even temporarily decline in a marked degree.

10. The modus operandi of rice is different from that of cereals rich in cellulose. Practically all the rice is absorbed and a certain amount is assimilated by the diabetic (this is evinced by the frequent increase in weight and vigor of the patient and the diminished glycosuria and acidosis), while material rich in cellulose, no matter how much albumin and fat may have been added to it, furnishes in effect nothing more than a starvation diet.

Carbohydrate Days. O. V. C. E. Petersen<sup>5</sup> reaches the conclusion that the importance of the carbohydrate days in the treatment of diabetes lies not in the use of any special cereal but in the fact that less nourishment is taken than needed for the system, so that they have the same action as the so-called hunger days, with the great advantage that the patient gets something to eat. By the use of various carbohydrates a variety can be given to the diet, if the rule is adhered to of giving less than the number of calories that are necessary for daily use.

Milk Cures. H. Strausse believes milk cures to be very useful in certain cases of diabetes, but their value depends on the individual tolerance for milk, which must be determined in each case. The oatmeal cure frequently fails to benefit. Recent research indicates that

<sup>(5)</sup> Deutsche med. Wochenschr., July 4, 1912.
(6) Deutsche med. Wochenschr., March 7, 1912.

oatmeal has no special advantage over wheat flour except possibly in isolated cases. Strauss has derived great benefit from an occasional fluid day in severe diabetes, permitting the patient on that day nothing but tea, coffee, bouillon, mineral waters, wine or brandy. He sometimes permits oranges with this "drink day," and says the advantages of this combination and of the occasional day of restriction to fluids are not generally appreciated as they should be. He remarks that a proportion of albumin less than 60 gm. a day is too low for the permanent ration, so that the oatmeal and wheat flour cures—which contain less albumin than this—cannot be kept up long at a time. These and similar diets owe their effect to the absence of meat and their low caloric value in general. Their comparative indigestibility is another valuable factor, as the slowness with which the granules of starch are assimilated aids in preventing glycosuria from them. Carbohydrates in general should be taken very little at a time. An amount of sugar which would induce alimentary glycosuria in the predisposed does not produce this effect if fractioned and distributed through the different hours of the day. Strauss reports that in his research and experience inulin was better tolerated than any other form of starch, and he urges its use in severe diabetes, especially for diabetics with acidosis. Comparatively small amounts are passed unutilized through the bowels, and he does not hesitate to urge its more general use on the transient course principle. As inulin is still so expensive, the best way is to order vegetables rich in inulin, such as artichokes and viper's grass (similar to salsify). He regards the progress of the last few years as mainly in the better appreciation of an exclusive or modified flour-soup cure with which vegetables can be combined. The restriction to a single form of carbohydrate is the main point in these cures. This is readily understood, as we know that when drugs with somewhat similar action are given together their effects are not only superposed, but have a direct cumulative action.

# THE URINE AND DISEASES OF THE KIDNEYS.

#### THE URINE.

Indican. C. Askenstedt describes a simple and improved quantitative test for indican. He uses a stock solution of indican blue, which can be furnished by any physician's supply house. The necessary equipment consists of a urinometer, funnel and filter paper; powdered corrosive sublimate, with a pair of small scales or balances, or tablets holding approximately 0.1 gm. of sublimate; two graduated test-tubes, of equal diameter, with cork stoppers (two ordinary test-tubes and a small graduate may be used): a solution of 0.3 or 0.4 per cent. iron perchlorid in hydrochloric acid; a solution of pure indigo blue in sulphuric acid, with dropper to which it is so adjusted that each drop will hold exactly 0.00615 mg. indigo blue; a solution of pieric acid in alcohol, about one to 5,000; chloroform; a solution of corrosive sublimate in alcohol, about one to 1.000 (denatured alcohol will answer).

The test is carried out as follows: For preliminary treatment, liberating indican, to 100 c.c. urine add 0.1 gm. of corrosive sublimate for every degree of specific gravity above 1,000; for example, for specific gravity of 1,010, 1 gm.; for 1,015, 1.5 gm.; for 1,022, 2.2 gm. Dissolve sublimate and set aside until a heavy precipitate is formed; to hasten it, when tardy, expose to cold. Remove the sediment by filtering twice through double filter paper, and pour exactly 10 c.c. of the filtrate into one of the test-tubes. Warm this until the tube begins to feel hot to the hand, then add 10 c.c. of the ferric chlorid solution, and mix by inverting the tube once; then add quickly 8 c.c. chloroform, and extract the

<sup>(7)</sup> N. Y. Med. Jour., June 29, 1912.

indigo forming by shaking the tube two or three minutes, holding it in a horizontal position. After this, let the chloroform fall to the bottom of the tube, then pour off most of the supernatant fluid, fill the tube nearly full with water, invert it a few times to wash the chloroform, let this again precipitate in the tube, and pour off most of the water. Repeat this process of washing, taking care that no chloroform escape with the wash water, and allowing not more than 2 or 3 c.c. of the last wash water to remain over the chloroform. Now add from 13 to 15 c.c. of the alcoholic solution of corrosive sublimate, and mix. A clear, blue fluid should result. If hazy, add 1 or 2 c.c. more of alcohol until the fluid clears up.

Keep this solution in a dark place when not in actual use. Compare the color of this fluid with an equal quantity of a standard solution of indigo blue in the second test-tube by holding the two test-tubes in front of a white surface, preferably a white blotter. This standard solution is made by pouring into the empty second tube a quantity of water equal to the amount of the fluid in the first tube, and then dropping the stock solution of indigo blue into the water, inverting the tube after each drop, until both solutions have the same amount of blue color. If this requires four drops of the stock solution the percentage is 0.0004; if five drops, 0.0005; if six drops, 0.0006; etc.

The indican extract will usually prove to be slightly greenish in color. By adding one or more drops of the picric acid solution to the standard solution in the test-tube, this can be made to conform to the color of the extract. Urine containing 0.0025 per cent. or more of indican, or giving a blackish extract, should be diluted with an equal quantity of water and retested.

Estimation of Calcium. W. Blair Bell's gives the following method of estimating calcium in urine: A sample from a twenty-four-hour specimen of urine is made faintly acid with hydrochloric acid to dissolve any insoluble phosphates present. It is then made faintly alkaline with ammonia, and filtered. Next 5 c.c. of the

 <sup>(8)</sup> Brit. Med. Jour., April 20, 1912.

filtrate are placed with a pipette in the special centrifuge tube, which is of the usual size and shape in the upper portion, but tapers at the lower end into a cylindrical extremity of even bore (1.25 mm.), and calibrated into 1 m.m. divisions. A line, with "urine" marked below it, encircles the upper part of the tube at the 5 c.c. level. Any air bubbles which may collect in the calibrated portion are got rid of with a fine wire or strand of silkworm-gut.

Then 1 c.c. of the reagent, consisting of a saturated solution of oxalic acid in a 5-per-cent. solution of acetic acid, is added. The correct quantity of reagent (1 c.c.) is also indicated by a line round the tube which is marked "reagent." Finally 2 c.c. of alcohol or methylated spirit are added, as indicated by the line marked "alcohol," and the contents of the tube are thoroughly mixed by shaking. The second tube is then taken, and 5 c.c. of the standard solution is run into it with a pipette up to the line marked "solution," and any air bubbles removed as before. Next the reagent and alcohol are added, as in the case of the first tube, and the whole is thoroughly shaken. Both tubes, with their calibrated ends packed in wool, are then carefully placed in the opposite buckets of a centrifuge, and are centrifuged for about a quarter of an hour.

On removing the tubes the precipitate will be found to stand at a certain height—say, 10 mm. in the "standard solution" tube, while it may stand at 7 mm. in the other, which contains the urine to be examined. As a rule, there is a slight slant on the surface of the deposit. This can be obviated by stopping the machine at the end of one or two minutes and turning the tubes through half a circle. The middle of the meniscus or slant is read off in each tube, and a comparison made between them. In the above instance the deposit in the tube containing standard solution was stated to stand at 10 mm., and that in the tube containing the urine at 7 mm.; consequently the urine contains seven-tenths, or 0.7 of the quantity in the standard solution, which is known to be 0.2 per cent., so that the urine contains  $0.02 \times 0.7$ = 0.014 per cent. of calcium.

This gives a general equation  $\frac{U}{S} \times \frac{1}{50}$  == percentage of

Ca in the urine examined, in which U = height in millimeters of precipitate in the urine examined and S = height in millimeters of precipitate in the standard solution. If the urine be found to contain an unusually large amount of calcium, so that the precipitate more than fills the calibrated portion of the tube, the urine should first be diluted with an equal quantity of distilled water, and the final result obtained in regard to the calcium content doubled. The method is accurate within 1 per cent.

### ALBUMINURIA.

Albuminuria of High Tension. A. E. Elliott<sup>1</sup> considers the albuminuria of high tension as presenting one of the most interesting problems in urinary diagnosis. Blood-pressure gauging by means of the clinical sphygmomanometer has brought us to a very different viewpoint in the estimation of such cases. The first fact we have learned is that high blood-pressure and cardiac hypertrophy with albumin and casts in the urine do not necessarily always mean nephritis as once was supposed, but may exist as a distinct syndrome. We have learned the important fact that albuminuria often exists because of high arterial tension: a consequence not necessarily always a cause as formerly interpreted. High blood-pressure may be the primary event, occurring quite independently of kidney disease. With hypertension established, the cardiac enlargement and albuminuria follow as consequences. The production of albuminuria is explained as follows: after a certain point in the morbid elevation of the blood-pressure is passed—usually about 200 mm.—the permeability of the renal filter is forced and albumin appears in the urine usually accompanied with casts. Whether this is the correct explanation or not, the fact remains that in every case of arterial hypertension the urine becomes albuminous after the tension exceeds a certain point.

<sup>(1)</sup> Interstate Med. Jour., July, 1911.

Quantitative urine analysis, ophthalmoscopy, and a careful weighing of the clinical evidence must decide the diagnosis in these cases. The physician must take a wide survey of all the attending circumstances and keep the patient under observation before coming to a conclusion. The manner in which albuminuria is brought about in arterial hypertension is antipodal to the production of the so-called vasomotor albuminurias already briefly considered. Persistent non-nephritic arterial hypertension is due to morbid vaso-constriction in the vessels of the splanchnic circulation, probably from sclerosis of the arteries of that circuit. As a result the glomerular blood-current is at so high a pitch of tension as to cause the passage of albumin into the urine. This is the opposite of conditions in orthostatic albuminuria which is associated with morbid vasodilation in the sphlanchnic area, the albuminuria resulting from low tension in the glomerular vessels.

Orthostatic Albuminuria. A. E. Elliott² suggests the following procedures for determining the presence of orthostatic albuminuria: First and most important is the careful comparison of the systolic blood-pressure between the lying, sitting and standing positions. The pressure is to be first taken while the patient is lying flat upon the back, then again immediately after, while he is sitting, and again while he is standing, the level of the sphygmomanometer being of course raised with each test until even with the heart. In orthostatic albuminuria there is an immediate fall of from 10 to 20 points in blood-pressure on the assumption of the sitting position; a deficit which may be slightly added to when the patient stands upright.

Secondly, the different urinations of the day voided into separate bottles on a two-hour schedule should be serially tested for the quantity of albumin present, and a curve of the albumin excretion made in this way. It will be found to pursue a more or less definite cycle, absent in the urine of rest, at its maximum toward noonday, declining steadily toward the close of the day. The specific influence of the upright position should be tested

<sup>(2)</sup> Ibid.

by devices that will at once suggest themselves. This latter precaution is necessary because in almost all forms of albuminuria there are daily variations in the amount of albumin, the minimum being found in the morning. Daremberg and Moriez<sup>s</sup> found only two exceptions to this rule in 100 observations. The time of occurrence of the maximum is somewhat uncertain and may, in different cases, vary between 11 a. m. and 5 p. m. The specific effect of change of posture alone is peculiar to orthostatic albuminuria.

Thirdly, the urine should be tested for the acetic-acid (euglobulin, nucleo-proteid) reaction. The method is as follows: Dilute 3 to 5 c.c. of the urine to be tested with 5 to 6 times its volume of cold distilled water and acidulate strongly by adding 2 to 3 c.c. of 50 per cent. acetic acid cold, not heating. A diffuse cloudiness follows the addition of the acid, and this is euglobulin or nucleo-proteid. The urine of orthostatic albuminuria almost invariably shows this reaction. Although not absolutely characteristic of this form of albuminuria, since it occurs under other circumstances, it may be looked upon as a strongly corroborative sign, and may generally speaking be taken as indicating the comparative harmlessness of the albuminuria. The more abundant this reaction, the better the prognosis.

Many of these cases do not show casts in the sediment even when the urine is heavily charged with albumin. This paradox does not hold good for every case, as hyaline casts may often be discovered if careful enough search is made for them. Unless the casts are of a degenerative type or are present in persistent and increasing number they should not be allowed to outweigh other considerations in arriving at the diagnosis of a harmless

albuminuria.

The Relation of Orthostatic Albuminuria to Acidity. E. Fraenkel<sup>4</sup> in the examination of some cases of orthostatic albuminuria has undertaken to determine the relation of albuminuria to the acidity of the urine in view of the claims of Fischer that albuminuria is occa-

<sup>(3)</sup> Rev. de Méd., September, 1902.
(4) Berlin. klin. Wochenschr., Oct. 17, 1912.

sioned by an excessive acidity in the kidney. His conclusions are as follows:

1. In a number of children with orthostatic albuminuria which was brought about or increased by an artificial lordosis an increase in the degree of acidity could also be demonstrated.

2. The excretion of albumin after the experiment could be reduced or prevented by the previous administration of a sufficient amount of sodium bicarbonate.

3. In a child whose disease presented the type of orthostatic albuminuria following a scarlatinous nephritis as well as in cases of scarlatinous nephritis, the administration of alkali produced no effect.

#### ALBUMOSURIA.

Test. E. H. Fittipaldi<sup>5</sup> describes the following method for testing for albumoses and peptones in urine: A small amount (10 or 20 c.c.) of urine are treated with six times its volume of absolute alcohol and left until the next day for the separation of any albuminous bodies that may be present. The alcohol is carefully poured off, the precipitate dissolved in the smallest possible quantity of soda lye (31 or 32 per cent.), and the alkaline solution tested with an ammoniacal nickel test solution. This solution is prepared by mixing equal quantities of ammonia solution and 5 per cent. solution of nickel sulphate. The mixture has a blue color and must always be freshly prepared. A drop of this mixture is added to the alkaline solution of the precipitated proteins. If albumose or peptone is present, the mixture assumes a reddish orange color either immediately or within a few seconds.

There is no need of a preliminary precipitation of albumin. The method can be applied to blood by first mixing with about an equal weight of purified animal charcoal, warming on the water bath with constant stirring with a glass rod; it is then heated to boiling, filtered after cooling and the filtrate treated like urine.

<sup>(5)</sup> Deutsche med. Wochenschr., Oct. 12, 1911.

#### CHYLURIA.

Chyluria results from an abnormal communication of a lymphatic vessel with the urinary tract. In Great Britain it is uncommon, but in tropical regions, where filariasis is endemic, chyluria is common. The filaria either causes an obstruction by blocking up the lymphatic tract, or the obstruction may be the result of secondary changes of an inflammatory type induced by the presence of the filaria. In either case the lymphatics distal to the obstruction become varicose, and chyluria is set up if one of the distended vessels ruptures into the patent urinary tract. It is obvious that any other obstruction, apart from filaria, which interferes with the normal passage of chyle and lymph through the thoracic duct may also cause chyluria by setting up, first, distention and varicosity of the vessels distal to the obstruction, and then rupture of one of the distended vessels. As a matter of fact, chyluria apart from filariasis seems very uncommon. Lüdke, in 1908, was able to collect only ten cases of non-parasitic chyluria from published records.

F. Charterise reports a case of persistent chyluria markedly influenced by posture. The patient first noted the chyluria in 1900; in 1902 observation showed that posture had an important effect upon the urine. If the patient lay down after taking a meal the urine became rapidly chylous. Thus as a rule the chyluria was most evident in the morning, especially if he had taken food just before going to bed. It is interesting to note that in the summer months the morning urine remained much clearer. This seemed to arise from the fact that the patient's occupation necessitated him being out of bed from 2 to 6 a.m. During the time the patient was in hospital chyluria could be induced at any time of the day by giving him a glass of milk and then making him lie on his back. Repeated and systematic examination of the blood failed to demonstrate any filaria even when films were made at two-hourly intervals for a consecutive period of 24 hours. Further observation in 1910

<sup>(6)</sup> Lancet, Oct. 7, 1911.

showed his condition to be practically unchanged, it being at least no worse.

The conclusion was reached that the chyluria was due to some intermittent pressure exerted on the thoracic duct by some factor which only became operative when the patient assumed certain attitudes. Probably the obstruction was a pedunculated calcareous gland. There was no enlargement to be felt in any of the abdominal glands, and an x-ray examination failed to reveal any calcareous masses. Still, on the whole, a movable enlarged gland seems to be the most likely explanation of the intermittent obstruction.

The patient would not allow a cystoscopic examination to be made, so that it was impossible to determine whether the chyle leaked into the bladder or was mixed with urine at a higher portion of the urinary tract. Lüdke was able to show that in his case of chyluria, which developed as a sequel to an inflammation of the bladder due to infection with *B. coli*, the urine left the ureters free from chyle, but became chylous in the bladder. Hertz examined a case of chyluria and post-mortem found the obstruction of the thoracic duct above the diaphragm, and the communicating ruptured lymphatic vessel in the bladder.

#### PAROXYSMAL HEMOGLOBINURIA.

J. Matsuo<sup>7</sup> gives the result of clinical and serologic investigations on 11 cases of paroxysmal hemoglobinuria.

1. In ten cases the action of cold was regarded as the sole exciting cause, but in one case this was combined with physical exhaustion. There were four female, and seven male patients. In four cases acquired syphilis must be regarded as the ultimate cause and in seven cases congenital syphilis.

2. In one case both the father and his daughter and in another case four blood relations (the patient, one sister, one male cousin and one female cousin) suffered from paroxysmal hemoglobinuria.

3. As to the result of the serologic investigation, in

<sup>(7)</sup> Deutsches Archiv. f. klin. Med.

four cases a constant autohemolysin was demonstrated. In three cases, negative at the beginning but positive later, and in the other four cases the test according to the original method of Donath-Landsteiner gave negative results, but after the addition of fresh, normal, human serum the result was positive.

- 4. Aside from individual variations in the strength of the autohemolysin there is observed a very pronounced time variation. In general the autohemolysin is weaker, the more frequently the attacks occur, and the shorter the time after the attack at which the investigation is made.
- 5. The variation of autohemolysin appears to depend partly on the amount of complement and partly on the amount of the autohemolysin.
- 6. The serum of hemoglobinurics frequently contains isohemolysins (45 per cent.). The isohemolysins undergo also great variation. It is frequently found that the variations in auto- and iso-hemolysins run parallel. The autohemolysins are regularly fortified by the addition of fresh, normal human serum, but the isohemolysins are influenced only to a slight degree or not at all and often the influence is negative.
- 7. In general the blood-cells of hemoglobinuria contain the isolysin and are protected against the action of isolysins from other hemoglobinurics. This protective mechanism is demonstrable by comparative examinations with other isolysin-containing and autolysin-free sera (from tuberculous and carcinomatous patients). The isolysins of hemoglobinurics and patients of other sorts must be identical.
- 8. The injection of salvarsan exerts almost no favorable influence on paroxysmal hemoglobinuria. The fact is worthy of note that not infrequently after the injection the Wassermann reaction disappears temporarily and returns after a short time.
- 9. Autohemolysin and the substance which provokes the Wassermann reaction are two very different substances, as Morot and Noda and later Gamada have asserted.

## DIABETES INSIPIDUS.

Etiology. E. Frank<sup>1</sup> reports a case which is like an experiment in the clinic, the peculiar circumstances causing disturbances similar to those induced in experimental research on the hypophysis. The patient, a man of 39, had epileptic seizures develop several years after he had tried to commit suicide by firing two bullets into his right temple. The balls could be seen in the head, one close to the cortex and the other close to the sella turcica. latter bullet evidently kept up a constant mechanical irritation of the hypophysis, and the result was the same as in Schäfer's similar experiments on dogs, a permanent diabetes insipidus and tendency to adipose-genital dystrophia. Other data indicating a connection between the hypophysis and development of diabetes insipidus are cited, including Hagenbach's case in which polyuria and polydipsia in a little girl were explained by a cheesy tubercle found in the infundibulum. Rosenhaupt has described a similar case, fever, thirst and polyuria coming on abruptly, and necropsy two weeks later revealing a sarcoma in the anterior lobe of the hypophysis. conclusion seems inevitable that the intermediate part of the hypophysis is a gland with an internal secretion which controls the activity of the kidneys, and that essential diabetes insipidus in man is the result of excessive functioning of this gland. The brain affections which are usually accompanied by diabetes insipidus are those in which there has been traumatic concussion of the brain, and the region of the hypophysis is exceptionally liable to suffer in trauma of the skull. Resulting cicatricial changes may exert a permanent irritating influence on the gland, which is also liable with brain tumors. by direct pressure or by pressure from excessive amounts of cerebrospinal fluid.

Classification. O. Steiger<sup>2</sup> divides cases of diabetes insipidus from a clinical standpoint into the following three classes: 1. Diabetes insipidus with manifest psychic disturbances. 2. Diabetes insipidus connected with dis-

<sup>(1)</sup> Berlin. klin. Wochenschr., Feb. 26, 1912.
(2) Deutsche med. Wochenschr., Oct. 3, 1912.

eases of the skull and of its contents. 3. Diabetes insipidus as the only pathologic symptom, the so-called idi-

opathic diabetes insipidus.

The author reports a case which may be regarded as a typical case of idiopathic diabetes insipidus. He sums up the results of his investigation as follows: In the absence of psychic disturbances and of diseases of the skull and its contents the case presents a typical picture of so-called idiopathic diabetes insipidus. Etiologically neither the kidneys nor the hypophysis could be made responsible for the condition, but in connection with this idiopathic diabetes insipidus there was demonstrable an abnormal condition of irritability of the vegetative nervous system and particularly of its autonomous part. as shown by the fact that a diminution of the amount of urine was produced by the administration of atropine and an increase by the action of pilocarpine. In all such cases of unexplained etiology the sympathetic nervous system should be carefully investigated.

Treatment. H. Strauss<sup>3</sup> notes the value of a saltfree diet in cases of polyuria and especially diabetes insipidus. The difficulty of diagnosis between diabetes insipidus and other forms of polyuria makes it difficult to apply this mode of therapy with exactness and it is found that the diet poor in salt frequently fails to affect the amount of urine. In some of these cases the restriction of salt must be accompanied by a similar restriction of liquids. The author prefers to begin with a diet containing little salt and a small amount of proteins, and if such a régime in the course of several days or at the most a week does not lead to a noticeable reduction of the polyuria he diminishes the amount of liquids slowly but at a steadily increasing rate. This method of procedure is well adapted to those cases in which there is a psychogenic basis for the consumption of an excess Some patients have acquired the habit of excessive water drinking, so that a limitation is accompanied by distressing thirst. These patients must be educated to restrain their tendency to consume liquids. Sometimes the thirst can be satisfied by the use of

<sup>(3)</sup> Deutsche med. Wochenschr., Oct. 17, 1912.

refreshing fruits or by the chewing of prunes or by rinsing the mouth with cold water, etc. The restriction

of liquids should not be pushed too rapidly.

In diabetes insipidus the food may be seasoned by other agents, but care should be taken not to use sharp spices like pepper, paprika, etc., in too large quantity as they may increase the thirst. The proteins should be reduced to from 60 to 70 gm. per day.

## NEPHRITIS.

Etiology. F. Billings' discusses chronic focal infections and their etiologic relation to arthritis and nephritis. It has long been known that acute rheumatic joint infections are the result frequently of a primary infection of the faucial tonsils, or tissues about them. Pneumonia is doubtless the frequent result of the sudden change of a non-virulent to a virulent type of pneumococcus whose common habitat is the upper respiratory passages in city dwellers. It has been shown that a common source of infection in epidemic cerebrospinal meningitis is the nasal mucous surfaces. Acute endocarditis also has its source, in many instances, from the faucial tonsils. Acute parenchymatous nephritis is frequently the result of the toxemia of diphtheria. Acute gonorrheal arthritis has its source in a focal infection of the urinary or genital tract. A local tuberculous focus may cause systemic infection.

Site of Focal Infection. 1. The faucial tonsils, the peritonsillar tissues and supratonsillar fossæ. In this may also be included the lymphoid tissue embraced in the pharyngeal tonsil and elsewhere in the nasopharyngeal space. The lymphoid tissue comprised in the tonsillar tissues is most abundant in childhood, and frequently becomes atrophic in adult life. The site of this tissue subjects it to infection of various kinds. The abundance of this tissue in the child probably explains the frequency of infections like acute rheumatic fever, diphtheria, tonsillitis, etc., in the earlier periods of life. The fact that chronic, septic, focal infection may lie

<sup>(4)</sup> Ill. Med. Jour., March, 1912.

latent in the tonsillar tissue has not been generally recognized. That this focal infection may produce a chronic systemic disease is established by clinical experimentation.

2. Abscesses of the gums and alveolar sockets, pyorrhea alveolaris and septic types of gingivitis may also

cause systemic disease of various types.

3. The various sinuses about the head—maxillary, ethmoidal, sphenoidal and frontal, may also harbor focal infection and cause systemic disease.

4. Bronchiectatic and pulmonic cavities due to chronic disease may also produce chronic systemic infections.

- 5. Chronic ulcers of the gastro-intestinal tract, especially of the bowels. This source is probably rare and more problematic than that of any other systemic infection.
- 6. Chronic appendicitis. Chronic catarrhal appendicitis may produce not only the local discomforts, including disturbance of the functions of the digestive organs, but it may also be a focal source of systemic infection with the damage done chiefly to the cardiovascular apparatus.
- 7. Cholecystitis and cholangeitis with or without calculi have been recognized as a source of systemic infection, the brunt of the damage apparently falling on the cardiovascular apparatus and kidney.

8. The urinary tract, including the pelvis of the kidney, the bladder and the more particularly the prostate gland. Pyelitis of whatever type, even when there is only moderate obstruction of the drainage of the

kidney pelvis, may produce myositis, arthritis, etc.

9. Genital tract. The prostate and seminal vesicles are a common source of infection of gonorrheal arthritis and probably of ordinary septic infections. The Fallopian tubes and uterus are less common as a source of chronic systemic disease in all probability. It is said that the parametrium is a more common focal source of infection.

10. Local, septic, submucous and subcutaneous foci anywhere in the body may be a source of systemic disease.

The systemic results of focal infection are as follows:

1. Chronic arthritis is one of the most common results.

2. Nephritis, both acute and chronic.

3. Cardiovascular degenerations.

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4. Chronic neuritis and myalgia (myositis).

Billings presents studies and experiments limited to the arthritides and to subacute and parenchymatous nephritis. Of these chronic deforming arthritis, commonly known as arthritis deformans, a chronic osteoarthritis of hypertrophic or atrophic type, comprise the majority of the studies. Next to the arthritides the largest number of cases comprises subacute parenchymatous nephritis and chronic parenchymatous nephritis.

The patient is carefully examined for foci of infection related to the systemic disease and attempt is made thoroughly to eradicate the focus of infection. dectomy, drainage of the gall-bladder or of the pelvis of the kidney is insisted on not only because of local discomforts related to these diseases, but quite as important, to prevent further systemic degeneration. The prostate and seminal vesicles easily may be reached by the finger and the septic contents removed. If necessary vasectomy and drainage may be carried out. Transillumination of the head may be made to determine the presence of sinusitis. The skilled specialist is necessary to remove these conditions by operation or treatment. The faucial tonsils should be enucleated. Ordinary tonsillectomy leaves an abundance of lymphoid tissue, which may be sealed over by the operative scar and leaves a worse condition than that for which the operation was made. Adhesions between the tonsils and pillars of the fauces frequently wall in foci of infection in peritonsillar tissues. supratonsillar fossa may contain lymphoid tissue and continue a source of focal infection even when the faucial tonsil is removed. Ulcerative gingivitis, small abscesses under the gums and collections of pus in the alveoli require vigorous treatment. Ill-fitted crowns on teeth and much bridge work may harbor septic infection in the mouth and produce systemic disease, and when found should be removed.

More than thirty cases so far have been under close observation whose original focal infection appeared to be in the tonsillar tissues. The result of the method of treatment in the majority of the patients has been most

successful. In two patients of the advanced type of chronic deforming arthritis, no beneficial result was obtained.

The effect of the inoculation of animals with the cultures obtained from infectious tissues has been studied. It is noteworthy that the streptococcus obtained in almost pure culture from many of the patients when inoculated into animals, produced an acute arthritis, either single or multiple, and in many of the animals produced an arthritis of deforming type. Furthermore, from the dead animals' tissues the streptococcus has been again obtained in cultures. It is also true that the cultures from the tonsils of patients who had no evidence of systemic infection, contained the streptococcus practically identical with those patients who had systemic diseases. Inoculation of the strains of the streptococci obtained from the tonsils of individuals, without systemic disease, has not yet been experimented with enough to know what the result on animals would be. It is an experimental fact that the streptococcus of any source may produce acute joint lesions in inoculated animals, especially rabbits. In most of the animals inoculated with the strain of streptococcus obtained from our patient, the usual acute arthritis occurred. In some of the animals the joint process became chronic and developed the marked anatomic changes (exostoses, rice bodies, atrophy of cartilage, subluxation, etc.), found in osteo-arthritis of man. It is also notable that in three of the patients suffering from nephritis, the strain of the streptococcus obtained from the tonsillar tissues of these patients produced albuminuria in the inoculated animals. No other strains produced albuminuria.

A few of the patients have been treated with autogenous vaccines. The vaccines invariably produced reactions when injected in the dose of from ten to five hundred millions. This reaction consisted of marked tenderness, redness and swelling and frequently of rise of temperature of varying degree with constitutional disturbance in the form of general discomfort, aching muscles, headache, etc. Leukocytosis of varying degree would sometimes follow the injections. Tenderness in

joints would also sometimes occur with the vaccinations. So far it cannot be said that the autogenous vaccinations have been of any special value in a group of patients. Individual patients have apparently shown greater improvement with the vaccinations than without them.

The final results do not seem due to the after-treatment alone for the same general treatment did not previously give as good results as was obtained by the treatment

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Anyone who has seen the illuminating results of a better physical health in patients whose dirty mouths have been made as nearly as possible clean, must be convinced of this source of systemic infection. The importance of the relation of the focal infection to systemic disease has not been fully recognized.

Partial removal of faucial tonsils, by whatever means, frequently leaves a condition as bad or worse than the original one. An infected tonsil or tonsillar tissue need not be large in bulk. In some of our patients small and apparently innocent tonsils contained abscesses from which pure cultures of streptococci were obtained. The scar of operation may seal over infected crypts in lymphoid tissue. An incomplete operation on the mouth may still leave alveolar abscesses. In several instances of patients included in this series more than one operation on the tonsils has been made necessary because of incomplete removal of the focus of infection by the first operator.

Experimental Evidence of Etiology. C. Hirsch and W. Maschke<sup>6</sup> report some interesting experimental work which may throw some light on the origin of nephritis. To determine the effect of various substances excreted by the kidneys they took the formation of granules in the kidney-cells as evidence of overfunctioning. They extirpated both kidneys of rabbits and allowed them to become uremic. The carotid of such a rabbit, with his blood full of excretory substances, was connected with the jugular of a healthy animal and the injured animal was allowed to bleed completely into the vessels of the other. When the latter animal was killed after some

<sup>(6)</sup> Berlin, klin. Wochenschr., Jan. 22, 1912.

time it was found that the granules in the kidney-cells were greatly increased, showing a great increase of function. Further observation showed that the kidney-cells were injured, being swollen and affected with cloudy swelling, while the nuclei, even of the cells of the glomeruli were very pale and the tubules contained a large number of degenerated cells and casts. There was also a pronounced hyperemia of the organs.

By another experiment they showed that when the urine was conducted from a severed ureter into the peritoneal cavity and again absorbed, the sound kidney showed evidence of increased function and resulting irri-

tation.

The authors endeavored to solve the question whether nephrolysins are formed when a part of the kidney is destroyed, as claimed by Ascoli. They exposed the kidney aseptically and destroyed a large part of the tissue with the actual cautery. The wound was closed and the kidney examined after some time. They found that there were degenerative changes in the remaining tissue but nothing to correspond with the theory of nephrolysins.

Experiments on the action of foreign albumins were made by injecting egg-albumin into the peritoneal cavity of rabbits. Albumin was constantly found in the urine. The examination of the kidneys showed that severe symptoms of degeneration do not appear after the long continued excretion of egg-albumin. They were able to follow the course of the egg-albumin and showed that egg-albumin passes out exclusively through the glomerulus and not through the tubules of the kidney. This indicates that other colloid substances may also find their exit by the same route. Further investigations will be necessary to determine whether the excretion of foreign albumin tends to cause degeneration of the cells of the glomerulus. An altered permeability, probably due to changes in the vessel walls must be assumed, even in orthostatic albuminuria.

Vascular Hypertension in Nephritis. R. I. Lee' gives the results of investigations on 53 cases with sys-

<sup>(7)</sup> Jour. Amer. Med. Assoc., Oct. 7, 1911.

tolic blood-pressure above 160 that came to necropsy.

Some kidney lesion was present at necropsy in over 71 per cent. of the cases of hypertension. In 13 per cent. the kidney lesion was essentially uncomplicated by other possible blood-pressure-raising factors; the lesion in the kidney was atrophic in 72 per cent. of the kidney cases. Hypertension also occurs in the so-called acute and subacute glomerulo-nephritis as well as in the atrophic form of nephritis. Arteriosclerosis was present in 69 per cent. of the cases, but in only one case could all other lesions which might cause hypertension be excluded.

In 15 cases no kidney lesion was found at autopsy. Seven of these cases presented cerebral lesions, seven cardiac lesions and one general arteriosclerosis. In every case of valvular disease of the heart, the aortic valve was involved. No patient without either nephritis or arteriosclerosis showed a blood-pressure of over 200. All the patients with repeated and constant blood-pressure readings of over 200 showed some kidney lesion.

In 38 of the 51 cases there were definitely hypertrophied hearts, yet in some instances high blood-pressures were observed to persist for days with hearts weighing less than 400 gm. The following conclusions seem justified:

1. Hypertension occurs most commonly in association with some lesion in the kidney. The most common lesion is an atrophic kidney with increase of connective tissue and disappearance of glomeruli. Hypertension occurs also in association with acute, subacute and chronic glomerulonephritis.

2. Hypertension occurs not infrequently in associa-

tion with cerebral lesions.

3. A moderate degree of hypertension may occur in cardiac lesions. In valvular cardiac lesions the aortic valve is apparently always involved.

4. Hypertension may occur rarely in cases of general arteriosclerosis without other lesions.

5. With a continued systolic blood-pressure of over 200, some form of nephritis is found.

6. Hypertension usually indicates well-marked cardiac hypertrophy.

**Treatment.** E. Romberg<sup>1</sup> calls attention to the fact that the excretion of water and sodium chlorid are more closely connected with the general condition of nephritic patients than albuminuria, hematuria and cylindruria. This is especially true of the two most important results of diseases of the kidney for the general system, namely, edema and uremia. To be sure, there are occasional cases of edema, and still more frequently cases of uremia, where the production of urine is sufficient, with a sufficient excretion of sodium chlorid. In general the two complications are less to be feared when the secretion of the kidneys is satisfactory. origin of edema cannot, however, be shown to depend solely on an insufficient secretion of water and sodium chlorid by the kidneys. There is associated with the injury to the kidneys a corresponding injury to the vessel walls, which permits the accumulation of liquid in the tissues, and this appears to be due to the same cause as the nephritis, but not immediately dependent on the latter.

In the treatment of chronic nephritis a distinction must be made between the treatment appropriate during the stages in which the action of the kidneys is sufficient and the involvement of the entire organism by the disease, and the treatment of edema and uremia as well as the acute exacerbations of the chronic process. In the stage of sufficiency of the kidneys the most important task is the sparing of kidney activity. This is to be obtained by the limitation of the nitrogenous diet, and the supply of a certain quantity of fluid for the day and by avoidance of directly injurious influences. The amount of meat should be limited to from 100 to 150 gm., and in those inclined to gout the purin bodies should be excluded. The amount of liquids should generally be about 2 liters in twenty-four hours.

Among injurious substances to be avoided common salt is included by a large number of clinicians. Romberg believes that this position is not justified. While a regulation of the amount of salt is of importance in case of insufficient kidney, it is only necessary for compen-

<sup>(1)</sup> Deutsche med. Wochenschr., June 6, 1912.

sated chronic nephritics to avoid an excess of common salt. In the author's opinion, active treatment of chronic nephritis during the stage of sufficient kidney function is of no value. Especially he warns against the unnecessary application of sweating measures. The same is true of the carrying out of a drinking treatment with mineral water. While these may be sometimes indicated especially for complications, their routine employment is not to be recommended. He also objects to sending such patients to a warm climate or to any marked change of climate. The actual cure of a chronic nephritis by residence in a warm climate can never occur. It is true that favorable results are often secured by spending the winter in a warm climate, but the author believes that this is due mainly to the rest and not to the climate. We have no means of affecting the process in the kidneys directly. The statement of von Hosslin that it is possible by administration of alkali markedly to reduce the excretions of albumin so that it may finally disappear is of great interest.

The decapsulation of the kidney he believes has fallen into disuse as a remedy for chronic nephritis. The removal of septic foci, especially in the tonsils, is to be considered. In the author's experience the removal of the tonsils has not secured the beneficial results which

are often shown in cases of rheumatism.

The treatment of insufficiency of the kidney demands first of all an extensive sparing of the affected organ. The rules suggested for the treatment of nephritis with sufficient excretion should be more rigorously enforced. The importance of restricting the supply of sodium chlorid is to be recognized, but in the experience of Romberg only a minority of patients with chronic nephritis respond to such treatment. Of greater importance for the treatment of eczema and uremia is the administration of diuretics, of which the most important are diuretin and theosin. The digitalis bodies may also be employed as adjuvants. Hedinger has investigated the action of such diuretics on pathologic kidneys in man. As in the experimental animals, the sensitiveness of the renal vessels is of prime importance. If there

exists a recognizable hypersensitiveness with polyuria there will be little occasion to employ diuretics, and in case their use seems necessary unexpected results may follow. On the other hand, in many cases the insensitiveness of the renal vessels is shown by marked diminution in the amount of urine. This is sometimes found particularly in arteriosclerotic patients with contracted kidneys. In such cases it is sometimes impossible permanently to increase the amount of urine by any diuretic. however large the dose. These cases offer an especially unfavorable prognosis. But between these two extremes there is a large class of chronic nephritides, in which the amount of urine is more or less inferior to the amount of liquid taken. These cases can be stimulated to a sufficient secretion by diuretics. Often very small doses are sufficient to secure a marked increase in the amount of urine and in that of sodium chlorid.

A frequent result of the action of these remedies is the removal of edema and the disappearance of uremic symptoms. This has been frequently attributed to the increased activity of the kidneys, but Romberg feels that an influence of the remedy on the general condition of the patient has not received sufficient attention. A matter of great practical interest has been established by Schlayer with reference to the administration of the xanthin bodies, diuretin and theosin. It is often observed that some days of especially good action of the kidneys are followed by a period in which there is a strikingly diminished secretion of urine. If the attempt is made to improve this diminished activity by increased doses of the remedy, the result, instead of that hoped for, is often an increased aggravation of the condition. This is an example of the well-known phenomenon in pharmacologic experiments of an exhaustion of the organ by diuretics, which have made too great demands on the kidney. Not infrequently in such cases the paradoxic phenomenon occurs that if one gives smaller doses of the remedy, or substitutes for theosin, the less active diuretin, a favorable and permanent effect is produced.

Treatment by Tonsillectomy. H. Eppinger<sup>2</sup> reports

<sup>(2)</sup> Wien. med. Wochenschr., No. 24, 1912.

three cases of acute nephritis following sore throat in which no improvement was secured by ordinary therapeutic measures pursued for over four months. It appeared as if a chronic nephritis was about to be established. The tonsils were enlarged in all three cases, and while there was no appearance of suppuration externally it was found that the deeper layers were filled with thick, foul-smelling pus. Immediately after the removal of these tonsils the condition of the kidneys was improved in a remarkable manner. The albuminuria and the excretion of blood-cells, which had resisted threemonths of suitable treatment, disappeared in two weeks after the operation, so that one could say that the disease was completely cured. The author has seen similar results in other cases and urges that in cases where the history indicates that an acute angina has preceded the nephritis, and where an inspection of the tonsils shows enlargement, the trial of removal should not be omitted.

Tomato Diet. A. Kakowski<sup>3</sup> gives the result of investigations of the influence of tomatoes on patients with nephritis. This matter was investigated in five cases, one of chronic parenchymatous nephritis, one of an exacerbation of interstitial nephritis, two cases of chronic interstitial nephritis and one of acute nephritis. The result of the observations was that even the repeated administration of large quantities of preserved and of raw tomatoes did not exercise a distinctly unfavorable influence on the course of the kidney disease. The author found a diminution in casts, kidney epithelium and red blood-cells, and an improvement in the general condition, which he is inclined to attribute to the influence of the tomatoes. At any rate, one must come to the conclusion that the occasional use of small quantities of tomato is not likely to harm patients with chronic nephritis. He has by similar clinical investigations reached analogous results with sorrel, spinach and young nettles. In the author's opinion these vegetables have not the injurious effect on the diseased kidney which is commonly attributed to them.

Salt Restriction. The subject of salt restriction in

<sup>(3)</sup> Berlin, klin. Wochenschr., Oct. 23, 1911.

edema is considered by A. C. Croftan.<sup>4</sup>. The sodium chlorid of the body fluids is normally maintained at a constant level. So long as the means of its output remain competent salt accumulation is merely temporary. About 2 gm. of sodium chlorid per diem suffice to maintain salt-equilibrium, and at least that amount must be added to the diet daily.

In many cases of nephritis, especially during the stage of good diuresis, the salt output parallels the salt intake. Retardation, however, is much more common. For, whereas a normal subject gets rid of all the sodium chlorid ingested within twenty-four or forty-eight hours, most nephritics require several days to accomplish the same result. The study of a single day's chlorid excretion, even when carefully compared with the intake, is therefore of very little value, particularly as fluctuations in the daily output of sodium chlorid are especially characteristic of nephritis.

When in nephritis the salt excretion is found to exceed the salt intake, this invariably indicates preced-

ing retention of sodium chlorid.

When the urinary salt output is smaller than the salt intake, we are, as a rule, dealing with renal inadequacy. This is readily demonstrated by the fact that in unilateral kidney disease the sick kidney eliminates less sodium chlorid than the healthy one. The addition of sodium chlorid to the diet as a test does not cause a corresponding increase of the sodium chlorid excretion, as in a normal subject; often, in fact, the excretion will become still further diminished thereby. There occurs, therefore, a true salt retention, particularly in acute nephritis at the height of the disease, in severe parenchymatous nephritis, in heart disease kidney, especially during the stage of decompensation, and in nearly all forms of glomerular nephritis.

Salt Retention and Edema. Salt retention is, as a rule, accompanied by edema, and when the proper elimination of sodium chlorid becomes reëstablished the edema decreases correspondingly. It is sometimes diffi-

<sup>(4)</sup> Jour. Amer. Med. Assoc., Feb. 17, 1912.

cult to determine whether the salt retention precedes the water retention, or vice versa.

Simple salt retention does not, however, explain all cases of nephritic edema and certain toxic factors no doubt play a rôle (chiefly, however, in determining the localization of the edemas). They become operative presumably by causing localized toxic permeability of blood-vessels, for we see quite similar phenomena in certain infectious diseases not associated with nephritis, especially in croupous pneumonia and in peritoneal tuberculosis, in the toxemia of gastric carcinoma and after certain drugs, as morphine and potassium iodid. Whenever nephritic edema is due to salt retention, then a reduction of the salt intake becomes a rational procedure; it is certainly less irrational than to attempt forced elimination of sodium chlorid through sick kidneys by drugs, when the kidneys have spontaneously manifested their inability to perform this function.

As a matter of fact, in proper cases, a diet poor in sodium chlorid aids immensely in the rapid elimination of retained sodium chlorid and of water, generally causing a decrease of the edema.

Salt Restriction and Drink Restriction. In very acute forms of nephritic edema salt restriction is fitly combined with drink restriction. Here the results are usually brilliant, especially as far as the edemas are concerned. One should not be afraid of scanty urine. The author often remains content with 8 to 12 ounces each twenty-four hours for many days or weeks, provided the liquid intake is kept below 20 ounces and provided the diet is low in salt and nitrogen. So far Croftan has never seen an accident of a uremic character; in fact, he has occasionally seen uremic headache, pulmonary edema and uremic asthma disappear. A drinking day occasionally, or a salt day, singly or combined, is a useful means of testing the renal capacity and the degree of retention of chlorids, or of retardation in their excretion.

The resumption of sodium chlorid feeding should be very gradual even after the edema disappears and the output equals the intake. One should stay near the minimal 2 gm. per diem ration as long as possible and

should control the balance between output and intake carefully. One should proceed here as gradually and carefully as in the resumption of starches and sugars after the use of a carbohydrate diet in diabetes mellitus.

Limitations of Salt Restriction. So simple a measure as the regulation of the table salt intake may assume therefore the dignity of a fundamentally important therapeutic inroad. Again empiricism has pointed the way and full scientific explanation must come a little later. In view of the occasionally brilliant results that have been obtained; in view of the apparently simple (and correspondingly incomplete and inaccurate) explanations that have been offered, enthusiasm has gone somewhat beyond bounds in regard to salt restriction as a therapeutic measure. It is by no means a panacea for all nephritic edemas. With careful selection of types and with methodic regulation and control, salt restriction can probably never do harm and will usually do good; but employed as a routine measure without control, promiscuously, in every case of edema, it will more often disappoint than fulfil the expectations based on it.

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